3.7 WETLANDS AND RIPARIAN LANDS

3.7.1 Introduction

Wetlands and riparian lands are closely related and are found throughout the Project Area. The riparian ecosystem lies adjacent to streams and reflects the influence and proximity to stream and associated groundwater (Malanson, 1993). Wetlands occur where groundwater maintains saturation of the soil for prolonged intervals. This water remains at or near the surface of the substrate long enough and frequently enough to induce the development of characteristic vegetative, physical, and chemical conditions corresponding to prolonged and frequent inundation (National Research Council [NRC], 1995). Thus, riparian lands and wetlands overlap spatially, but are not identical (Lewis, 1995) (Figure 3.7-1). Consequently, wetlands and riparian lands are considered separately in this section.

3.7.2 Wetlands

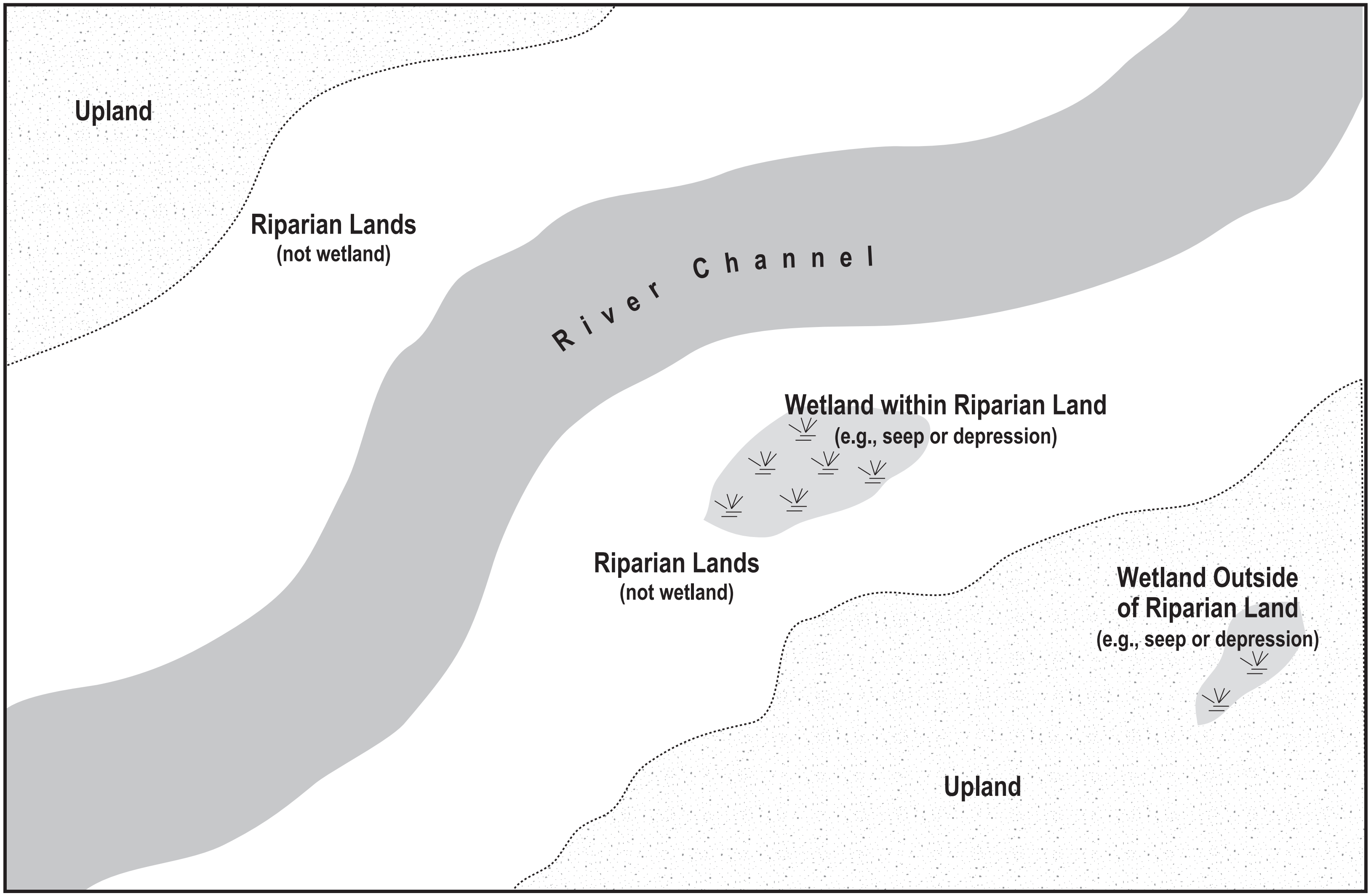
3.7.2.1 Affected Environment

Wetlands are found at the interface between terrestrial and aquatic ecosystems. These systems are generally characterized by (1) soil that is inundated or saturated long enough during the growing season to typically develop anaerobic conditions; (2) vegetation that grows in water or on a substrate that is, at a minimum, periodically deficient in oxygen as a result of excessive water content; and (3) characteristics that are associated with areas inundated or saturated to the surface during the growing season in most years. The Corps formally defines wetlands as "those areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Federal Register, 1986)." This definition includes forested swamps, marshes, bogs, and other similar areas.

For federal regulatory purposes, wetlands are considered a subclass of Special Aquatic Sites (40 FPR Section 230.3) and have been deemed waters of the United States (33 FPR 328.3). All waters of the United States are subject to regulation by the Corps and the EPA through the CWA. Additionally, Executive Order 11990 requires federal agencies "to avoid....adverse impacts associated with the destruction or modification of wetlands...wherever there is a practicable alternative." To fulfill this requirement, under Section 404 of the CWA, the Corps has developed methodology to identify and delineate wetland sites.

Wetland Functions

Wetland ecosystems provide a variety of physical, biological, and socioeconomic functions. The National Wetland Policy Forum (Conservation Foundation, 1988) identified eight natural functions that wetlands may perform at a landscape level: (1) nutrient removal and transformation, (2) sediment and toxicant retention, (3) shoreline and bank stabilization, (4) flood flow alteration, (5) groundwater recharge, (6) production export, (7) aquatic diversity



SOURCE: Lewis (1996)

Figure 3.7-1.
Example of Spatial Overlay Between Wetlands and Riparian Zones

and abundance, and (8) wildlife diversity and abundance. Values of these wetland functions to society include recreation, water quality enhancement, and flood attenuation (Table 3.7-1).

Not all wetland sites provide all the values discussed above due to site-specific characteristics and varying wetland locations within the landscape. For example, a small shrub wetland may provide specific habitat requirements for a wildlife species but not serve a hydrologic function (e.g., flood retention or water quality). An emergent wetland may have significant water quality and flood alteration values but not provide groundwater recharge due to an impermeable substrate beneath the wetland.

Wildlife Species Associated with Wetland Ecosystems

The structure and diversity of wetland ecosystems provide a variety of habitats for wildlife species. Wetland and associated riparian habitats have been found to be used by more species of wildlife than any other habitat type (Brinson et al., 1981; Kauffman and Krueger, 1984). Some wildlife species depend completely upon wetland ecosystems, while others use this habitat type opportunistically. All sizes of wetlands can be important for wildlife species; therefore, size is not the main determinant for a wetland's value. Due to a lack of fish species, for example, many small, shallow wetlands have been found to contain some of the highest densities of amphibian populations (Washington Department of Fish and Wildlife [WDFW], 1992). Wildlife that uses wetlands and adjoining habitats within the Project Area includes mammals, fish, amphibian, invertebrates, and avian species. Section 3.10 provides more specific information regarding sensitive wildlife species that use wetland ecosystems.

Wetland Types

Wetlands are described here using the FWS wetland classification system (Cowardin et al., 1979). This system was developed in conjunction with the National Wetland Inventory (NWI) maps, which are used to determine the type and amount of wetlands on PALCO and Elk River Timber Company lands.

The Cowardin et al. (1979) system is hierarchical. Wetlands and deepwater habitats are divided between different systems at the broadest level (e.g., palustrine and riverine). Vegetation and substrate are defined at the "class" level (e.g., forested wetland, emergent wetland, and shrub-scrub wetland). Only palustrine wetland systems are described within this section. Riverine wetland systems, which include streams and rivers and their associated riparian habitat, are described in Sections 3.4, 3.7.3, and 3.8. Wetlands found within the Project Area consist of the classes described in Table 3.7-2.

The NWI maps were developed from aerial photography with limited ground truthing. Identifying wetlands based on aerial photography can lead to underepresentation of wetland sites at the landscape level (Corps, 1994). Additionally, data depicted on NWI maps reflect the status of habitats as of the aerial photograph date. Landscape changes that occur after that date are not represented.

Project Area Wetlands

Using NWI maps, an estimated 486 acres of palustrine wetlands occur on PALCO and Elk River Timber Company lands. The acreage consists of 392 acres of forested land, 29 acres of open water, 57 acres of scrub-shrub, and 11 acres of emergent wetlands (Table 3.7-3). The small acreages of wetlands within the Project Area are mostly due to topography.

Table 3.7-1. Wetland Functions

Function	Benefit
Groundwater recharge	Increased water supplies; blockage or dilution of contamination
Floodflow alteration	Flood control
Sediment stabilization	Shoreline protection
Sediment/toxicant retention	Improved downstream environment
Nutrient removal/transformation	Tertiary waste treatment by nature
Production	Food chain support
Aquatic diversity/abundance	Food chain support
Wildlife diversity/abundance	Recreational hunting and observation

Source: Adapted from Adamus et al. (1991)

Table 3.7-2. Definitions of Wetlands and Deepwater Habitats

System

Palustrine (P)

Includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand (ppt).

Class

Forested (FO)

Is characterized by woody vegetation greater than 20 feet (6 meters) tall.

Emergent (EM)

Is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years.

Open Water

Is characterized by open water habitats that do not support surface water aquatic vegetation.

Shrub Scrub

Is characterized by woody vegetation less than 20 feet (6 meters) tall.

Unconsolidated Bottom (UB)

Includes all wetlands and deepwater habitats with at least 25 percent cover of particles smaller than stones (less than 6 to 7 centimeters) and a vegetative cover less than 30 percent.

Source: Cowardin et al. (1979)

Much of the Project Area land base has steep slopes; therefore, wetlands are infrequent and are small, when present. Additionally, because of the steep landscape, many of the wetlands are found at lower landscape positions and are associated with riparian areas.

As described in Section 3.6, 4,600 to 5,000 acres of PALCO's land is leased for grazing. Approximately 600 head of cattle (cow/calf pairs) graze these lands year-round. Much of the grazed land is located on ridgetops; therefore, it does not impact wetland ecosystems. Areas that contain wetland/riparian habitats include South Rainbow Ranch (1,800 acres), Chase Ranch (1,250 acres), North Rainbow Ranch (830 acres), Patmorc Cabin (442 acres), Chalk Mountain (71 acres), and Corbett Ranch (23 acres). For a more detailed description of PALCO's leased grazing lands, see Grazing in Section 3.6.

3.7.2.2 Environmental Effects

Timber harvest and associated activities, such as road construction and use, affect wetland sites by changing species composition, reducing stand density and shading, changing fuel profiles, altering disturbance regimes, altering successional rates and pathways, altering hydrologic regimes (short-term increases in water level due to plant eradication or soil compaction), increasing undesirable vegetation, and altering nutrient/chemical cycles (Castelle et al., 1992; Harris and Marshall, 1963; Darnell et al., 1976) (Table 3.7-4). Vehicular crossings in streams can cause sediment inputs into wetlands downstream and may alter water flows in streams feeding wetlands, thus stressing fish, amphibians, and plants. Additionally, forestry practices may lead to an increased influx of noxious or weedy plants into forested wetland sites via road building, road use, or habitat disturbance. The magnitude of these changes depends, in part, on the intensity, location, and duration of the road construction/use or timber harvest activity.

Grazing activities can affect wetlands by increasing siltation and by changing wetland vegetation composition. Grazing compacts soil, reducing moisture infiltration and increasing runoff. Removal of vegetation allows soil temperatures to rise and increases evaporation from the soil surface. Additionally, grazing animals can trample existing vegetation and can cause the introduction and spread of exotic plant species by reducing plant density and increasing the availability of bare ground (Mackie, 1978).

A method of reducing impacts from land management activities on wetlands is to apply a protective buffer around the sites. Wetland buffers play a key role in moderating water level fluctuations, and vegetation with buffer zones can increase the humus content of the soil and increase adsorption and infiltration. Characteristics of buffer zones, particularly slope and vegetative cover, directly influence the buffer zone's effectiveness. The effectiveness of removing sediments, nutrients, bacteria, and other pollutants from surface water runoff increases with buffer width. Although buffer protection distances for wetlands can vary markedly, depending upon site conditions, buffers of 100 feet or greater have been found to control coarse and fine sediments (Broderson, 1973; Corbett and Lynch, 1985; Lynch et al., 1985). Additionally, buffers of 100 feet have been found to maintain water temperatures within one degree Celsius of average temperature (Lynch et al., 1985).

To protect wetland values for wetland-associated wildlife species, slightly larger buffers, ranging from 200 to 300 feet, have been suggested (WDFW, 1992).

Table 3.7-3. Acres of Wetlands (Systems and Classes) Within the WAAs on PALCO and Elk River Timber Company Lands

WAA	NWI[1/]	Acre[2/]	Wetland Percentages Within WAAs[3/]	Total Acreage[4/]
Humboldt	PSU	0.3	< 0.01	36,399
	PEM	11	0.03	
	PFO	44	0.15	
	PSS	9	0.02	
Yager	PSS	4	0.01	33,753
	PFO	37	0.12	
Van Duzen	PSS	44	0.18	24,944
	PFO	57	0.23	
Eel	POW	29	0.04	74,313
	PFO	157	0.22	
Bear Mattole	PFO	91	0.3	30,495
Total		486	0.24	199,904

1/ PSU = Palustrine Unconsolidated shore; POW = Palustrine Open Water; PEM = Palustrine Emergent; PSS = Palustrine Scrub-Shrub; PFO = Palustrine Forested.

2/ Wetlands represented by linear measurements on NWI maps were converted to acres using an estimated 50-foot width.

3/ Values in this column are obtained by dividing the acreage of the wetland by the acreage of the WAA.

4/ Approximately 4 acres of wetlands was estimated to occur within Elk River Timber Company lands. PEM=3 acres, PSS=1 acre.

Source: NWI Data.

Table 3.7-4. Off-site Impact on Wetlands (Timber Management)

Activity	Nature of Impact
Traffic or construction upslope	Erosion carries sediment into wetland; stresses fish, amphibians, and small plants; buries seeds deeper than would naturally occur; sediment may carry petroleum products and toxic compounds that stress fish, amphibians, and plants; and raised floor alters hydraulic regime.
Timber harvest upstream of wetlands	Increases storm runoff and decreases upland storage and post-storm release. Erosion and sedimentation will also be increased. Stresses fish, amphibians, and plants.

Source: Adapted from Corps (1994)

Federal Laws

The Corps' regulatory jurisdiction over potential impacts of timber harvest operations on wetlands is based on Section 404 of the CWA. This act prohibits the discharge of dredged or fill material into waters of the United States without a Corps permit.

Exemptions are granted for Section 404 permits for normal agricultural, ranching, and silvicultural activities, as well as for maintenance of existing drains, farm ponds, and roads (Section 404[f][1]). Under Section 404 of the CWA, the construction or maintenance of forest roads is exempt from regulation in instances where such roads are constructed and maintained in accordance with BMPs. The BMPs "assure that flow and circulation patterns and chemical and biological characteristics of water of the United States are not impaired, that the reach of the waters of the United States is not reduced, and that any adverse effect on the aquatic environment will be otherwise minimized."

California FPRs

The FPRs (916.3, 936.3, and 956.3) limit timber harvesting near lakes, marshes, meadows, and other wet areas. Wet meadows and other wet areas are defined in the rules as those natural areas, except cutover timberland, which are moist on the surface throughout most of the year and support aquatic vegetation, grasses, and forbs as their principal vegetation cover. The FPRs state that the quality and beneficial uses of water shall not be unreasonably degraded by timber operations. Degradation includes the filling or polluting of wetlands in quantities that would diminish wildlife habitats or water quality. Vegetation, other than commercial species, bordering and covering meadows and wet areas is to be retained and protected during timber harvest activities, unless justified. Before timber harvest, wetland resources are to be surveyed. All wetland sites with aquatic life are identified as Class II waters and buffered accordingly. Forested wetlands sites (similar to Class IV waters) are not buffered; however, these sites must be evaluated on a site-by-site basis, and, if applicable, buffers must be established. Furthermore, road construction associated with timber harvest activities is precluded within wetlands, except when explained or justified.

Activities in wetlands associated with rivers, streams, or lakes may be subject to CDFG Code Section 1603 and, therefore, may require Section 1603 Agreements. PALCO's proposed Section 1603 Agreement covers certain types of these activities and provides mitigation for their effects (PALCO, 1998, Volume VI, Part E). Activities not covered by PALCO's proposed Section 1603 Agreement would be subject to separate individual Section 1603 Agreements, the terms of which would be negotiated with PALCO on a case-by-case basis.

Evaluation of Alternatives

The effects of the proposed alternatives on wetland resources were evaluated by comparing alternative-specific wetland and riparian protection measures and the number of acres of wetlands protected in no-harvest areas (e.g., proposed Headwaters Reserve, marbled murrelet habitat, and RMZs) under each of the alternatives. Also, sediment delivery from existing road systems on PALCO lands was considered. Although road densities would remain relatively consistent under all alternatives, there are differences among the alternatives in the level of road use. Therefore, potential sediment delivery from roads to wetland systems varies among the alternatives.

Most of the wetlands on PALCO and Elk River Timber Company lands are associated with riparian areas and, therefore, are afforded protection by the RMZs established under each of the alternatives. These riparian buffers form the basis for much of the wetland impact analysis.

Threshold of Significance

The interrelationship of management activities, environmental components or systems, and related thresholds of significance, are discussed in Section 3.1 and illustrated in Figure 3.1-1. Section 3.1 describes the interrelationship of effects among the environmental components and the related thresholds of significance for Sections 3.4, Watersheds, Hydrology, and Floodplains, 3.6, Soils and

Geomorphology, 3.7, Wetlands and Riparian Lands, and 3.8, Fish and Aquatic Habitat.

Under FPRs, the threshold of significance for wetlands is exceeded (significant impacts) if the beneficial uses of water are unreasonably degraded by land management activities. To avoid exceeding this threshold, vegetation, other than commercial species bordering and covering wet areas, shall be retained and protected, and soil within wet areas shall be protected as much as possible.

Grazing (All Alternatives)

As noted in Section 2.5.1, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA the No Action alternative is not projected into the long-term future. In the short term, the conformance with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP and site specific basis. Compliance is attained by a wide variety of mitigation measures tailored to local conditions such that significant environmental effects and take of listed species are avoided. Consequently, most significant environmental effects of individual THPs can be expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5.1, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs as well as restrictions on the harvest of old growth redwood forest to model conditions over the short and long term. Ranges of RMZs are considered qualitatively because it is expected that adequate buffer widths could vary as a result of varying conditions on PALCO lands.

Currently about 600 cow/calf pairs graze on PALCO lands. This number has decreased from a historical figure of 2,000 to 3,000 cow/calf pairs. No specific on-site rangeland evaluations have been completed on PALCO's leased lands. Therefore, little information exists on the effects that cattle have had on wetland ecosystems within the parcels. Because of the lack of information, it is difficult to evaluate impacts under the alternatives. However, current grazing practices indicate that, overall, minimal impacts have occurred to wetland resources. Many riparian and wetland areas used for grazing within the parcels are fenced or contain topographical features that limit cattle grazing. Additionally, grazing pressure within PALCO's lands is relatively low (0.1 to 18 acres per AMU; see Section 3.6.3.7). Moreover, the livestock on PALCO lands is widely dispersed, which diminishes localized effects. On a larger scale, water quality does not appear to be significantly impacted by grazing in the region (NCRWQCB, 1993).

Under Alternatives 1 and 3, grazing activities would continue at a level consistent with past use. None of the grazing areas is within any of the proposed reserves. Although there may be significant localized adverse effects, at a larger scale, less-than-significant effects would be anticipated to occur on wetland systems due to current low grazing pressure, physical features that limit access to wet areas, and the patchy distribution of leased parcels.

Under Alternatives 2 and 4, PALCO's HCP would be implemented. Under the HCP, grazing pressure may be increased from its current level of 600 to 1,000 cow/calf pairs at any one time during the term of the ITPs (PALCO HCP, 1998). Overall, it is anticipated that less-than-significant impacts would likely occur to wetland ecosystems since cattle stocking levels would remain relatively low and many parcels contain fences or features that limit cattle access to riparian areas. However, increased grazing pressure on PALCO lands may significantly impact local wetland ecosystems in portions of the leased parcels due to the affinity of cattle for wetland ecosystems. Areas most likely to have localized degradation may include the South Rainbow Ranch (1,800 acres) and the Chase Ranch (1,250 acres). These areas are characterized by steep terrain and contain major creeks. Due to cattle's avoidance of steep terrain, they tend to congregate in riparian and wetland habitats. These areas may be somewhat degraded due to vegetation alteration, channel/bank widening, and channel aggradation (Armour et al., 1991). Grazing on other parcels may have less-than-significant effects on wetland systems (see Section 3.6).

PALCO's proposed mitigation is to evaluate grazing in specific watersheds as part of the watershed analysis process. If watershed evaluations indicate that grazing is having an adverse effect on aquatic resources, additional mitigation measures would be used during the prescription-writing phase of watershed analysis. These mitigation prescriptions could include fencing streams to prevent access, rotating periods of grazing with periods of rest, providing alternate sources of water (other than watercourses), and ceasing all grazing activity (PALCO HCP, 1998).

Timber Harvest and Related Activities: Alternative 1 (No Action/No Project)

As noted in Section 2.5.1, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA the No Action alternative is not projected into the long-term future. In the short term, the conformance with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP and site specific basis. Compliance is attained by a wide variety of mitigation measures tailored to local conditions such that significant environmental effects and take of listed species are avoided. Consequently, most significant environmental effects of individual THPs can be expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5.1, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs as well as restrictions on the harvest of old growth redwood forest to model conditions over the short and long term. Ranges of RMZs are considered qualitatively because it is expected that adequate buffer widths could vary as a result of varying conditions on PALCO lands.

Under Alternative 1, no acquisition or exchange of lands would occur, and management of wetlands would continue under current management guidelines. PALCO would continue to conduct timber harvest on its lands under FPRs in a manner similar to present operations. Of the 486 acres of wetlands within PALCO ownership, approximately 401 acres are associated with riparian habitats and would be protected by the associated RMZs (Table 3.7-5). This represents the largest acreage of protected wetlands when compared to the other alternatives (see Table 3.7-5). Wetlands located outside of these RMZ buffers (approximately 85 acres) could be impacted by harvest of timber within or adjacent to wetland sites. This could result in alteration of vegetation and hydrology. Additionally, indirect effects such as sedimentation could occur from upslope harvest practices and roads. The greatest impacts would probably be to forested wetland sites, due to likely timber harvest. Most forested wetland sites are within the Eel River WAA. Under FPRs, however, wetland sites would be evaluated before harvest, and wetlands containing aquatic life would be protected through the establishment of Class II buffers (50 to 100 feet), resulting in less-than-significant impacts to wetland resources. Because roads must avoid wetlands, the potential effects are minimal.

Alternatives 2 (Proposed Action/ Proposed Project) and 2a (No Elk River Property)

Under Alternative 2, approximately four acres of wetlands would be fully protected within the established Headwaters Reserve, and an additional 77 acres of wetlands would be protected within the no-harvest RMZs on Class I and II streams (Table 3.7-5). These acreages represent the minimum amount of wetland acres that would be protected under no-harvest buffers if watershed analysis were conducted and 30-foot, no-harvest buffers were implemented on Class I and Class II streams. Additionally, under watershed analysis, wetlands would be identified before harvest and protected accordingly. A maximum of 243 acres of wetlands would occur within late-seral prescription RMZs (referred to as reduced harvest) if watershed analysis buffers were implemented along Class I and Class II streams. If RMZs established under the HCP were implemented, a substantial amount of these acreages might be protected within RMZ no-harvest zones. Although reduced-harvest buffers may not provide full protection for wetland ecosystems, no significant impacts are likely to occur due to the low level of harvest within these areas. Residual vegetation left after harvest would minimize the effects of wetland sites on the microclimate and provide mechanisms for filtering out sediment.

Approximately 162 acres are found outside of RMZs. The greatest impacts would likely occur to forested wetland sites. Most of these sites occur in the Eel WAA. These wetlands are susceptible to impacts from harvest operations. However, as stated under Alternative 1, applying CDF requirements, wetland sites would be evaluated before harvest and would be buffered accordingly. Wetlands that are not provided with buffers are expected to receive impacts from forest harvest operations; however, impacts at the watershed level would not be significant. Some of these operations could require a Section 1603 Agreement with CDFG to minimize and mitigate effects to fish and wildlife resources. PALCO's proposed Section 1603 Agreement covers certain types of activities and provides mitigation for their effects (PALCO, 1998, Volume VI, Part E). Activities not covered by PALCO's proposed Section 1603 Agreement would be subject to individual Section 1603 Agreements, the terms of which would be negotiated with PALCO on a case-by-case basis.

Alternative 2 provides the greatest protective against road-related sedimentation when compared to the other alternatives. Stormproofing and other associated protective measures would reduce sediment input to wetland sites (see Section 3.6).

Alternative 2b is identical to Alternative 2 except for the transfer of Elk River Timber Company lands. Therefore, the approximately four acres of wetlands occurring on Elk River Timber Company ownership would not be transferred to PALCO (three acres) or to the Reserve (one acre) and would be managed according to CDF regulations (discussed earlier).

Table 3.7-5. Comparison of Wetland Protection by Alternative

Alternative	1	2	2 a	3	4
No harvest [1/]	401	81	77	396	172
Selective harvest within RMZ buffer [2/]	0	243	243	13	206
No buffer (RMZ) [3/]	85	162	162	77	108
Total wetland acres	486	486	482	486	486

1/ Includes the reserves, RMZs, and other no-harvest buffers (wildlife, old-growth). RMZs represent a minimum no-cut buffer (30 feet) that could be implemented on Class I and Class II streams after watershed analysis is performed.

2/ See Section 3.7.4.3 for description of management within buffers.

3/ Harvest areas would be surveyed before timber management activities; wetlands containing aquatic life would receive a Class II buffer (FPRs).

Source: Foster Wheeler Environmental Corporation

No significant impacts are anticipated to occur on PALCO's or Elk River Timber Company's ownership under these alternatives. However, both Alternatives 2 and 2a have the least level of protection for wetland resources when compared to the other alternatives due to smaller no-harvest buffers along riparian zones.

Based on public comment, the FESA and CESA issuance criteria, the agencies consider that additional mitigation would be appropriate to reduce the risk of potential adverse effects. These additional mitigation measures would further reduce the impacts as described in the Draft and Final EIS/EIR. This additional mitigation is summarized in Section 3.7.5.

Alternative 3 (Property-wide Selective Harvest)

This alternative provides the second-largest no-harvest area of all the alternatives and, therefore, would have fewer potential effects on wetland resources than Alternatives 2 and 4. Alternative 1 is more protective than Alternative 3. Approximately 226 acres of wetlands are found within Class I, II, and III no-harvest RMZs. This alternative provides full protection for the wetlands in riparian areas through the designated 340-foot, no-harvest RMZs on Class I streams, 170-foot RMZs on Class II streams, and 100-foot RMZs on Class III streams. Although these areas would be subject to selective harvest after watershed and site-specific analysis, these analyses would identify wetlands and provide measures to protect them, resulting in less-than-significant effects. Full protection would be provided for the approximately 170 acres in old-growth Reserve areas.

Approximately 13 acres of wetlands are found within buffer areas. These areas would receive reduced harvest, which would have minimal effects on the wetlands. The approximately 77 acres of wetlands outside the RMZs and Headwaters Reserve could be affected directly (vegetation and hydrology alteration) and indirectly (sedimentation from upslope harvest) by timber harvest operations. Per CDF regulations wetlands would be surveyed before harvest and buffered accordingly, resulting in no significant impacts.

Wetlands within RMZs and Reserve no-harvest areas (396 acres) would receive full protection from road sedimentation. Wetlands located outside of no-harvest areas and RMZs (77 acres) could be negatively affected by sedimentation due to roads. However, this alternative would reduce sediment delivery to streams (wetlands) on PALCO property by incorporating a zero net sediment discharge requirement on the five watersheds identified by CDF as cumulatively impacted for sediment. Additionally, it would incorporate the procedures for road sediment (Weaver and Hagans, 1994) and would use sediment source investigations of the lower Eel River (Pacific Watershed Associates, 1998, unpublished report) to begin minimizing existing sediment delivery to streams. These two procedures would be applied at rates that would address all HUs on PALCO's ownership by the end of the 50-year HCP period.

Alternative 4 (63,000-acre No-harvest Public Reserve)

This alternative provides greater protection to wetland resources than Alternatives 2 and 2a, but less protection than Alternatives 1 and 3. Under this alternative, RMZs for Class I, II, and III streams are the same as for Alternative 2 (Table 3.7-5). Therefore, this alternative would provide the same level of protection to wetland resources located within RMZs as discussed within Alternative 2. However, an additional 111 acres of wetlands would be fully protected within the established 63,000-acre Headwaters Reserve, resulting in 172 fully protected wetland acres (Table 3.7-5). Approximately 206 acres of wetlands occurs within reduced-harvest RMZs on PALCO property, resulting in minimal effects due to the low level of harvest. Approximately 108 acres of wetlands outside of the no-harvest areas and RMZ buffers could be negatively impacted by timber harvest operations (discussed in Alternative 2). Sedimentation effects from roads would be greater than for the other alternatives, because less stringent sediment control mechanisms would occur under this alternative. Additionally, wetlands identified as Class II or otherwise significant would be provided buffers, lessening potential impacts. The effects on wetlands are less than significant under Alternatives 2 and 2a.

3.7.2.3 Mitigation

In the Draft HCP, the applicant provided suggested minimization and mitigation measures that have been analyzed in the Draft EIS/EIR and, for CEQA purposes, in the Final EIS/EIR as resulting in less than significant effects to affected resources. However, after reviewing and evaluating public comments on the Draft EIS/EIR in light of FESA and CESA permit issuance criteria, the wildlife agencies have determined that additional measures are appropriate to minimize and fully mitigate the impacts of take and to further reduce potential adverse effects. The complete package of minimization and mitigation measures is presented in the proposed HCP's Operating Conservation Program in Appendix P. Section 3.7.5 provides a summary of these measures. The pertinent mitigation provides for RMZs along Class III streams. Though wetlands are not common adjacent to Class III streams because of the steeper gradients in these areas, these RMZs will provide more protection for any wetlands that do occur in these locations.

3.7.3 Riparian Lands

3.7.3.1 Affected Environment

Riparian lands include instream habitat and stream channels, adjacent floodplains (discussed in Section 3.4), and wetlands. Raedeke (1988) describes riparian systems as having long, linear shapes with high edge-to-area ratios and microclimates distinct from those of adjacent upland areas. Water is present at or near the soil surface during all or part of the year, resulting in variable soil moisture conditions and distinct plant communities. Periodic flooding causes habitat disturbances that result in a greater natural plant diversity than is present in the surrounding upland areas. The area adjacent to streams also contributes substantially to the quality of aquatic habitat, as discussed in Riparian Functions below. The RMZs discussed in the alternatives may be much wider than any true riparian habitat, as identified by distinct microclimates, soil moisture conditions, or plant communities.

Riparian Functions

Many authors have reviewed the various functions of riparian systems (e.g., Karr and Schlosser, 1977; Meehan et al., 1977; Raedeke, 1988; Bilby, 1988; Murphy and Meehan, 1991; Beschta, 1991; Castelle et al., 1991). Some commonly recognized functions of stream riparian lands include the following:

- Providing protective canopy that shades the stream channel, which helps to maintain stream temperatures (see Section 3.4)
- Contributing LWD to streams, thus shaping channel morphology, retaining organic matter, and providing instream cover for aquatic organisms
- Adding leaf and needle litter to streams that fuel the aquatic food chain
- Stabilizing streambanks and maintaining undercut banks that offer prime habitat for salmon and trout
- Controlling sediment inputs from surface erosion
- Regulating nutrient and pollutant inputs to streams
- Slowing water velocity on the floodplain, thus inhibiting erosion along stream and river banks, thereby reducing sediment input to streams

These functions of riparian lands are integral to the maintenance and development of a functioning aquatic system that successfully supports salmon and trout populations. Riparian lands can also provide critical habitats for many terrestrial and semi-aquatic organisms (see Section 3.10) and serve as migration or dispersion corridors for wildlife species (Forest Ecosystem Management Team [FEMAT], 1993). Some of these benefits are derived from the availability of water and unique microclimates within riparian lands.

Riparian Land Protection

Within the scientific community, protection of riparian lands is considered central to salmonid conservation efforts (FEMAT, 1993; Cederholm, 1994; Murphy, 1995). Protection of water quality and fish habitat is given highest management priority, but buffers may also be designed to benefit wildlife and other non-fish aquatic species.

RMZs (also known as stream buffers) are lands immediately adjacent to stream channels or floodplains. These areas are established to protect and maintain functions of the riparian lands and aquatic resources by restricting or eliminating land-use activities within an administratively defined area. Riparian management most often involves two main features: (1) establishment of a protective buffer width and (2) restrictions on allowable activities (e.g., timber harvest prescriptions) within the buffer.

California FPRs

Under FPRs (CDF, 1997a), the riparian system is managed according to WLPZs. The width requirements of the WLPZs depend on stream class, sideslope, and yarding method (Table 3.7-6). For Class I (fish-bearing) streams, the WLPZ width ranges from 75 feet where sideslopes are less than 30 percent to 150 feet where sideslopes exceed 50 percent. For Class II (non-fish) streams, the WLPZ width ranges from 50 feet where sideslopes are less than 30 percent to 100 feet where sideslopes exceed 50 percent. The WLPZs along Class I and II streams in areas of steep sideslopes can be reduced if cable yarding is used instead of tractor yarding. The need for and width of WLPZs along Class III (no aquatic life) watercourses are determined by on-site inspection. In addition, activities

Table 3.7-6. Minimum FPR Widths Required for WLPZs by Slope Class and Stream Class[1/]

Slope Class (percent)	Stream Class (ft) Class I Fish-Bearing	Stream Class II Nonfish-Bearing	Stream Class III (No Aquatic Life)
<30 percent	75	50	Site-specific[2/]
30 to 50 percent	100	75	Site-specific[2/]
>50 percent	150[3/]	100[4/]	Site-specific[2/]

Source: CDF, 1997a
1/ Measured as slope distance (i.e., compared to horizontal distance).
2/ The need for and width of WLPZs is determined by on-site inspection.
3/ Subtract 50 feet for cable yarding.
4/ Subtract 25 feet for cable yarding.

in riparian areas may be subject to Fish and Game Code Section 1603 and, therefore, may require a Section 1603 Agreement with CDFG. PALCO's proposed Section 1603 Agreement covers certain types of these activities and provides mitigation for their effects on fish and wildlife (PALCO, 1998, Volume VI, Part E). Activities not covered by PALCO's proposed Section 1603 Agreement would be subject to individual Section 1603 Agreements, the terms of which would be negotiated on a case-by-case basis with PALCO.

Riparian Condition

WLPZ requirements (CDF, 1997a) for width by slope and stream classes were used to determine the amount of riparian land available on PALCO and Elk River Timber Company lands. Class III streams were given a standard buffer of 25 feet to ensure that riparian areas adjacent to Class III streams were represented in the riparian land acreage, despite the fact that development of WLPZs under FPRs is rare. Of the total 949,963 acres in the summed HUs, there is approximately 39,754 acres of WLPZs. Of this, 17,437 acres of WLPZs is on PALCO lands (Table 3.7-7), and 736 acres of WLPZs is on Elk River Timber Company lands. Under current WLPZ rules, approximately four percent of the land base is classified as riparian.

PALCO is proposing to manage its lands using WLPZs. Under the HCP/SYP, the widths of these management zones and prescriptions within the zones differ from CDF's FPRs. In general, PALCO's proposed management provides a greater level of protection for riparian resources. However, CDF's WLPZ widths and prescriptions were used to estimate the available riparian lands that exist under recent FPRs, prior to coho considerations.

Riparian Vegetation Inventory

Vegetation structure within the WLPZ is described in terms of seral and vegetation stage. Seral stage classifications for these areas are categorized by PALCO (1998) as forest opening, young forest, mid-seral forest, late-seral forest, uncut old-growth, prairie, open natural, and hardwood (for definition of the seral stages, see Section 3.9).

Table 3.7-8 characterizes vegetation in the WLPZ for each hydrologic unit for PALCO and Elk River Timber Company lands. Intensive timber harvest and road building have resulted in major changes in riparian vegetation and habitat in the Project Area (Kelsey, 1980; Anderson, 1970; Ziemer, 1981; Nolan and Janda, 1981; Salo and Cundy, 1987). Within the PALCO and Elk River Timber Company lands, 18,173 acres (within the 17 HUs) is classified as riparian lands (using existing WLPZ widths). These

Table 3.7-7. Summary of Riparian and Total Hydrologic Unit Acres by Ownership based on WLPZs

		Elk River Lands		PALCO Lands		Other Ownership		Grand Total	
WAA	**HU**	**Riparian Acres**	**Total Acres**	**Riparian Acres**	**Total Acres**	**Riparian Acres**	**Total Acres**	**Riparian Acres**	**Total Acres**
Bear/Mattole River	Bear River	0	0	1,502	16,538	1,034	49,756	2,536	66,295
	Mattole Delta	0	0	291	3,869	1,512	52,602	1,803	56,471
	NF Mattole River	0	0	418	5,317	1,163	17,449	1,581	22,765
	Upper NF Mattole	0	0	763	8,788	789	8,714	1,552	17,502
Bear/Mattole River Total		**0**	**0**	**2,975**	**34,512**	**4,498**	**128,521**	**7,472**	**163,034**
Eel River	Eel Delta	0	0	858	10,777	2,799	80,835	3,657	91,612
	Giants Ave	0	0	102	2,247	4,250	130,722	4,353	132,969
	Larabee Cr	0	0	1,459	15,009	447	41,362	1,907	56,370
	Lower Eel	0	0	2,795	36,016	888	8,251	3,683	44,266
	Sequoia	0	0	985	11,576	1,449	89,381	2,434	100,956
Eel River Total		**0**	**0**	**6,199**	**75,624**	**9,834**	**350,550**	**16,033**	**426,174**
Humboldt Bay	Elk River	735	9,333	1,350	17,087	447	7,418	2,532	33,838
	Freshwater Cr	0	0	1,272	15,427	329	12,239	1,601	27,666
	Jacoby Cr	0	0	26	379	299	12,649	325	13,028
	Other	0	71	3	87	635	40,952	638	41,109
	Salmon Cr	0	65	279	3,694	630	9,242	909	13,001
Humboldt Bay Total		**735**	**9,468**	**2,929**	**36,673**	**2,340**	**82,500**	**6,005**	**128,641**
Mad River	Butler Valley	0	0	116	1,805	1,119	51,293	1,235	53,098
	Iaqua Buttes	0	0	210	2,099	260	36,957	470	39,056
Mad River Total		**0**	**0**	**326**	**3,904**	**1,379**	**88,250**	**1,705**	**92,154**
Van Duzen River	Van Duzen WAA	0	0	1,943	24,945	1,746	30,422	3,689	55,367
Van Duzen River Total		**0**	**0**	**1,943**	**24,945**	**1,746**	**30,422**	**3,689**	**55,367**
Yager Creek	Lawrence Cr	0	0	1,356	15,193	886	11,734	2,242	26,926
	Lower Yager	0	0	1,236	14,434	17	313	1,253	14,747
	Middle Yager	0	0	245	2,401	793	10,415	1,038	12,816
	North Yager	0	0	227	2,117	88	27,988	316	30,105
Yager Creek Total		**0**	**0**	**3,065**	**34,145**	**1,785**	**50,449**	**4,849**	**84,594**
Grand Total		**735**	**9,468**	**17,437**	**209,803**	**21,581**	**730,692**	**39,754**	**949,963**

Source: Foster Wheeler Environmental Corporation

Table 3.7-8. Summary of Riparian Acres by Seral Stage and Hydrologic Unit for PALCO and Elk River Lands Based on WLPZs

WAA Name	Hydrologic Unit	Open Natural (ON)	Grass (G)	Hardwood (H)	Forest Openings (O)	Young Forest (Y)	Mid-Seral (M)	Late Seral (L)	Old Growth (OG)	Total
PALCO Lands										
Bear/Mattole River	Bear River	224	12	0	22	25	1,096	17	106	**1,502**
	Mattole Delta	1	6	0	3	14	266	1	0	**291**
	NF Mattole River	50	2	0	6	20	83	32	226	**418**
	Upper NF Mattole	120	47	31	0	9	483	38	34	**763**
Bear/Mattole River Total		*395*	*67*	*31*	*31*	*68*	*1,929*	*89*	*366*	***2,975***
Eel River	Eel Delta	13	5	9	20	75	360	371	5	**858**
	Giants Ave	0	0	0	0	21	64	17	0	**102**
	Larabee Creek	122	5	219	82	134	508	313	75	**1,459**
	Lower Eel	163	10	12	131	409	1,060	1,004	6	**2,795**
	Sequoia	107	1	9	25	242	322	259	19	**985**
Eel River Total		*405*	*23*	*248*	*258*	*881*	*2,315*	*1,964*	*105*	***6,199***
Humboldt Bay	Elk River	1	0	24	38	236	521	388	142	**1,350**
	Freshwater Creek	12	0	18	21	105	413	698	7	**1,272**
	Jacoby Creek	0	0	0	0	0	16	10	0	**26**
	Other	0	0	0	0	0	1	2	0	**3**
	Salmon Creek	0	0	2	4	28	76	30	138	**279**
Humboldt Bay Total		*14*	*0*	*44*	*63*	*369*	*1,026*	*1,128*	*286*	***2,929***
Mad River	Butler Valley	0	3	7	0	0	106	0	0	**116**
	Iaqua Buttes	0	7	6	0	0	198	0	0	**210**
Mad River Total		*0*	*10*	*13*	*0*	*0*	*304*	*0*	*0*	***326***
Van Duzen River	Van Duzen WAA	176	16	6	15	165	1,179	378	6	**1,943**
Van Duzen River Total		*176*	*16*	*6*	*15*	*165*	*1,179*	*378*	*6*	***1,943***
Yager Creek	Lawrence Creek	33	6	0	19	544	506	120	128	**1,356**
	Lower Yager	202	0	2	6	291	443	255	38	**1,236**
	Middle Yager	0	0	0	2	97	79	15	51	**245**
	North Yager	28	0	12	2	91	88	3	4	**227**
Yager Creek Total		*263*	*7*	*14*	*28*	*1,023*	*1,117*	*392*	*221*	***3,065***
Total		**1,253**	**123**	**356**	**395**	**2,507**	**7,870**	**3,951**	**984**	**17,437**
Elk River Lands										
Humboldt Bay	Elk River	123	0	0	0	38	89	485	0	**735**
	Salmon Creek	0	0	0	0	0	0	0	0	**0**
Humboldt Bay Total		*123*	*0*	*0*	*0*	*38*	*89*	*485*	*0*	***736***
Total		**123**	**0**	**0**	**0**	**38**	**89**	**485**	**0**	**736**
Grand Total		**1,376**	**123**	**356**	**395**	**2,545**	**7,959**	**4,436**	**984**	**18,173**

Source: Foster Wheeler Environmental Corporation

riparian land widths (derived from PALCO 1996 GIS layer) are based on different stream types (Class I, II, and III) rather than field-verified riparian ecosystems. Of this total, 16 percent comprises young forest (2,545 acres) and forest openings (395 acres), 44 percent is mid seral (7,959 acres), while 30 percent is late-successional forest (4,436 acres) and uncut old growth (984 acres). The remaining 10 percent of the riparian areas is land that does not support conifers (e.g., prairie and non-forested lands).

Although 30 percent of riparian vegetation in the PALCO and Elk River Timber Company lands is late-seral stage or old-growth forest, the largest proportion (50 percent) is found in the Elk River, Freshwater Creek, and Lower Eel HUs. Approximately 47 percent of the total riparian vegetation that comprises young, open forest, and mid-seral forest is found in the Van Duzen, Bear River, Lawrence Creek, and Lower Eel HUs.

ROADS IN RIPARIAN LANDS

Road engineers have often taken advantage of flat bottomlands along rivers for road building or have used old railroad grades that historically had railroad tracks. Many riparian roads on PALCO's land follow old railroad grades. These roads have displaced riparian vegetation on the flood plain. In narrow canyons with limited bottomlands, roads commonly have been located on the sideslope within the riparian zone. Even in the absence of these longitudinal impacts, the continuity of the riparian corridor has been interrupted at each bridge and culvert crossing (Kondolf et al., 1996) (see Section 3.12 for discussion on effects of road crossings on water quality). Consequently, the effects from roads built in riparian lands have changed riparian forest structure and composition and caused permanent land disturbance. These changes have caused the loss of some or all riparian functions within riparian lands, depending on where road construction has occurred. Major changes to the aquatic system have also occurred from riparian land modifications due to roads (Kondolf et al., 1996).

Table 3.7-9 shows the miles and acres of road that currently exist within WLPZs on PALCO and Elk River Timber Company lands for each HU. Roads vary in width on PALCO and Elk River Timber Company lands, averaging between 50 and 75 feet when considering the entire road prism. An average width of 60 feet was used to calculate the acres of riparian lands currently converted to road. On PALCO lands, there are 80 miles of road found within the WLPZs. Most (30 percent) of these roads are found in the Van Duzen (12 miles) and Lower Eel (12 miles) HUs. Approximately 1.5 to 4.0 percent of the acres of riparian land have been converted to acres of road in most of the HUs. The Elk River (4.3 percent), Van Duzen (4.3 percent), Lower Yager (4.3 percent), and Lawrence Creek (5.1 percent) HUs, however, exceed four percent. The Mattole Delta (0.5 percent), North Fork Mattole (0.8 percent), Upper North Fork Mattole (1.4 percent), Jacoby Creek (1.4 percent), Butler Valley (0.8 percent), and Iaqua Buttes (0.5 percent) have road acres of less than 1.5 percent. On Elk River lands, 2.4 percent of the riparian land acres on the Elk River HU has been converted to road acres.

Grazing

As described in Section 3.6, PALCO leases approximately 4,600 to 5,000 acres of its land for grazing. Approximately 600 head of cattle (cow/calf pairs) graze these lands year-round. Much of the grazed land is located on ridgetops and therefore does not impact riparian resources. Grazed lands that were found to contain riparian resources include South Rainbow Ranch (1,800 acres), Chase Ranch (1,250 acres), and Corbett Ranch (23 acres). Rangeland

Table 3.7-9. Miles and Acres of Roads Found in WLPZ by Ownership

WAA	HU	Elk River Lands Miles of Road	Acres of Road	PALCO Miles of Road	Acres of Road	Other Ownership Miles of Road	Acres of Road	Grand Total Miles of Road	Acres of Road
Bear/Mattole River	Bear River	0.0	0.0	3.9	28.2	1.6	11.8	5.5	40.0
	Mattole Delta	0.0	0.0	0.2	1.5	2.8	20.1	3.0	21.6
	NF Mattole River	0.0	0.0	0.5	3.3	1.8	13.3	2.3	16.6
	Upper NF Mattole	0.0	0.0	1.4	10.4	2.0	14.6	3.4	25.1
Bear/Mattole River Total		**0.0**	**0.0**	**6.0**	**43.4**	**8.2**	**59.9**	**14.2**	**103.3**
Eel River	Eel Delta	0.0	0.0	3.5	25.7	4.6	33.2	8.1	58.9
	Giants Ave	0.0	0.0	0.5	3.7	2.7	19.8	3.2	23.6
	Larabee Cr	0.0	0.0	7.4	53.8	1.6	11.7	9.0	65.4
	Lower Eel	0.0	0.0	12.1	87.8	4.2	30.7	16.3	118.5
	Sequoia	0.0	0.0	4.9	35.4	3.6	25.8	8.4	61.2
Eel River Total		**0.0**	**0.0**	**28.4**	**206.3**	**16.7**	**121.4**	**45.1**	**327.7**
Humboldt Bay	Elk River	2.4	17.4	7.9	57.4	0.8	6.1	11.1	80.9
	Freshwater Cr	0.0	0.0	5.3	38.4	0.8	6.1	6.1	44.4
	Jacoby Cr	0.0	0.0	0.1	0.4	1.2	8.5	1.2	8.8
	Other	0.0	0.0	0.0	0.1	0.6	4.7	0.7	4.8
	Salmon Cr	0.0	0.0	1.5	11.1	0.7	5.3	2.3	16.4
Humboldt Bay Total		**2.4**	**17.4**	**14.8**	**107.3**	**4.2**	**30.7**	**21.4**	**155.3**
Mad River	Butler Valley	0.0	0.0	0.1	1.0	0.4	2.7	0.5	3.7
	Iaqua Buttes	0.0	0.0	0.1	1.0	0.0	0.3	0.2	1.3
Mad River Total		**0.0**	**0.0**	**0.3**	**2.0**	**0.4**	**3.0**	**0.7**	**5.0**
Van Duzen River	Van Duzen WAA	0.0	0.0	11.5	83.6	3.6	26.4	15.1	109.9
Van Duzen River Total		**0.0**	**0.0**	**11.5**	**83.6**	**3.6**	**26.4**	**15.1**	**109.9**
Yager Creek	Lawrence Cr	0.0	0.0	9.5	69.4	1.1	8.3	10.7	77.7
	Lower Yager	0.0	0.0	7.4	53.6	0.0	0.3	7.4	54.0
	Middle Yager	0.0	0.0	1.2	8.4	0.7	5.2	1.9	13.5
	North Yager	0.0	0.0	1.0	7.6	0.3	2.2	1.3	9.8
Yager Creek Total		**0.0**	**0.0**	**19.1**	**139.0**	**2.2**	**16.0**	**21.3**	**155.0**
Grand Total		**2.4**	**17.4**	**80.0**	**581.7**	**35.4**	**257.3**	**117.8**	**856.4**

Source: Foster Wheeler Environmental Corporation

inventories have not been completed within these parcels; therefore, the current condition of these lands and riparian areas within them is unknown. Grazing pressure within individual leased parcels ranges from 4 to 14 acres per cow (averaging 8 acres per cow overall). Many factors (including vegetation structure and composition, topography, and water availability) can influence the quality of rangeland for grazing. Appropriate grazing pressure for these areas was estimated at between 6 and 10 acres per cow. See Section 3.6 for further information concerning grazing and associated effects.

3.7.4 Environmental Effects

The establishment of RMZs is generally accepted as the most effective way of protecting aquatic and riparian habitats (Cummins et al., 1994). The anticipated effects of the proposed alternatives on riparian habitats were evaluated based primarily on the current or proposed widths and management prescriptions within RMZs and the associated acreages of these habitats as regulated by various state, federal, and/or PALCO HCP/SYP management requirements.

3.7.4.1 Riparian Function Criteria

Criteria used to determine the effectiveness of proposed width and management activity for each alternative, based on the riparian ecosystem function, are discussed in Section 3.7.3.1. The effectiveness can be best evaluated within the context of specific protection goals. For example, riparian standards designed to protect only salmonid habitats would differ substantially from standards to protect other riparian-dependent species, including amphibians, birds, and mammals. As a result, these functions are briefly summarized, and buffer-width requirements that provide full protection to a functioning aquatic ecosystem are identified in the following section.

The summaries are based on a wide variety of literature, as discussed below. The generalized curves in Figures 3.7.2a, b, c, d, and e illustrate the relationship between width and level of protection. These curves are generally conservative (i.e., they reflect the widest buffers needed to provide complete protection, as identified in the literature). Note, however, that the evaluation in Section 3.7.4.3 also considers lesser widths and other circumstances as appropriate.

Stream Shade

Clearing streamside riparian vegetation during timber harvest can increase solar insulation to a stream, raising stream temperatures above water quality standards. High stream temperature significantly affects the aquatic environment and associated species, including fish (Beschta et al., 1987).

To determine whether riparian habitat provides shade to stream channels, several site-specific factors must be considered. These include composition of vegetation, stand height, stand density, latitude (which determines solar angle), topography, and orientation of the stream channel. These factors influence how much incident solar radiation reaches the forest canopy and the fraction that passes through to the water surface (Spence et al., 1996). Belt et al. (1992) reviewed numerous studies and results indicated that removal of forest canopy within a buffer strip can reduce its effectiveness by diminishing shade and thereby increasing stream temperatures.

Brazier and Brown (1973) found that the best measure of forest cover necessary to maintain streamwater temperatures was ACD. Whereas canopy density is usually expressed as a vertical projection of the canopy onto a horizontal surface, ACD is a projection of the canopy measured at the angle above the horizon at which direct-beam solar radiation passes through the canopy. This angle is determined by the position of the sun above the horizon during the portion of the day when solar heating of a stream is most significant. Thus, ACD can provide a direct estimate of the shading effects of streamside vegetation. Brazier and Brown (1973) found that ACD densities comparable to old-growth stands (i.e., 80 to 90 percent ACD) could be attained with buffers of approximately 72 to 100 feet for coniferous forests in the southern Cascades and Oregon Coast Range. Steinblums et al. (1984) determined that an ACD of approximately 100 percent could be achieved by buffer strips greater than 125 feet. Based primarily on the literature above, several authors have concluded that buffers of 100 feet provide adequate shade to stream systems (Murphy, 1995; Johnson and Ryba, 1992). If the buffer is less than 100 feet, or if the buffer is selectively logged, considerations such as species composition, stand age, and vegetation density become important factors (Beschta et al., 1987). Beschta et al. (1987) concluded that 100 feet of buffer provides 100 percent of ACD in old growth. The generalized curves presented by FEMAT (1993) for forests in the range of the spotted owl suggest that cumulative effectiveness for shading approaches 100 percent at a distance of approximately 0.75 tree height from the stream channel (see Figure 3.7-2a). For a forest with an average tree height of 170 feet, a 100 percent effective buffer for temperature is expected to be approximately 130 feet.

In areas where partial or complete exposure of the stream causes increased stream temperatures, the rate of shade recovery depends on streamside conditions, vegetation, and stream size (Beschta et al., 1987). Small streams may be quickly overtopped by brush and effectively shaded from solar radiation, while larger streams, which require tall conifers for shade, require longer times. Reestablishment of canopy cover over streams ranges from 5 to 40 years (Gregory and Bisson, 1997).

LWD Recruitment

Numerous studies have shown that LWD is an important component of fish habitat (Swanson et al., 1976; Bisson et al., 1987; and Naiman et al., 1992). Trees that fall into streams are critical for sediment retention (Keller and Swanson, 1979; Sedell et al., 1988), gradient modification (Bilby, 1979), structural diversity (Ralph et al., 1994), nutrient production (Cummins, 1974), and protective cover from predators.

Large wood that enters stream channels originates from a variety of sources including tree mortality, windthrow, debris avalanches, deep-seated mass soil movements, undercutting of streambanks, and redistribution from upstream (Swanson and Lienkamper, 1978). Most assessments of buffer-width requirements for maintaining natural levels of LWD have considered only wood originating from tree mortality, windthrow, and bank undercutting (Spence et al., 1996).

The potential for trees to enter a stream channel from tree mortality, windthrow, and bank undercutting is mainly a function of slope distance from the stream channel in relationship to tree height. As a result, the zone of influence for LWD recruitment is determined by the particular stand characteristics rather than an absolute distance from the stream channel or floodplain. Slope and prevailing wind direction are other factors that can affect the amount of LWD recruited to a stream (Spence et al., 1996). To maintain full recruitment potential of LWD to the stream channel, all trees within the zone of influence must be protected.

FEMAT (1993) concluded that the probability of wood entering the active stream channel from greater than one tree height is generally low. McDade et al. (1990) estimated that for old-growth conifer forests in Oregon, 50 percent of debris originates within 39 feet of the stream, 85 percent within 100 feet, and 100 percent within 165 to 182 feet. For mature forest, McDade et al. (1990) values are 33, 75, and 154 feet, respectively. They also showed that 90 percent of LWD in mature forests originated within 89 feet of the stream channel (see Figure 3.7-2b). Two widely used models of LWD recruitment also assume that large wood from areas outside one tree height seldom reaches the stream channel (Van Sickle and Gregory, 1990; Robison and Beschta, 1990). Cederholm (1994) reviewed the literature regarding recommendations of buffer widths for maintaining recruitment of LWD to streams and found that most authors recommended buffers of 100 to 200 feet to maintain this function. Most recent studies suggest buffers approaching one site-potential tree height are sufficient to maintain 100 percent natural levels of recruitment of LWD (Spence et al., 1996) (see Figure 3.7-2b). The potential size distribution of LWD is also an important factor when considering the appropriate activities in buffer strips relative to LWD potential recruitment. Larger pieces of wood form key structural elements in streams and, thus, serve to retain smaller debris that would otherwise be transported downstream during high flows (Murphy, 1995). The size of these key pieces is approximately 12 inches or more in diameter and 16 feet in length for streams less than 16 feet wide and 24 inches or more in diameter and 39 feet in length for streams greater than 66 feet wide (Bisson et al., 1987). As a result, riparian management zones must ensure not only an appropriate amount or volume of wood, but wood of sufficient size to serve as "key pieces" (Spence et al., 1996).

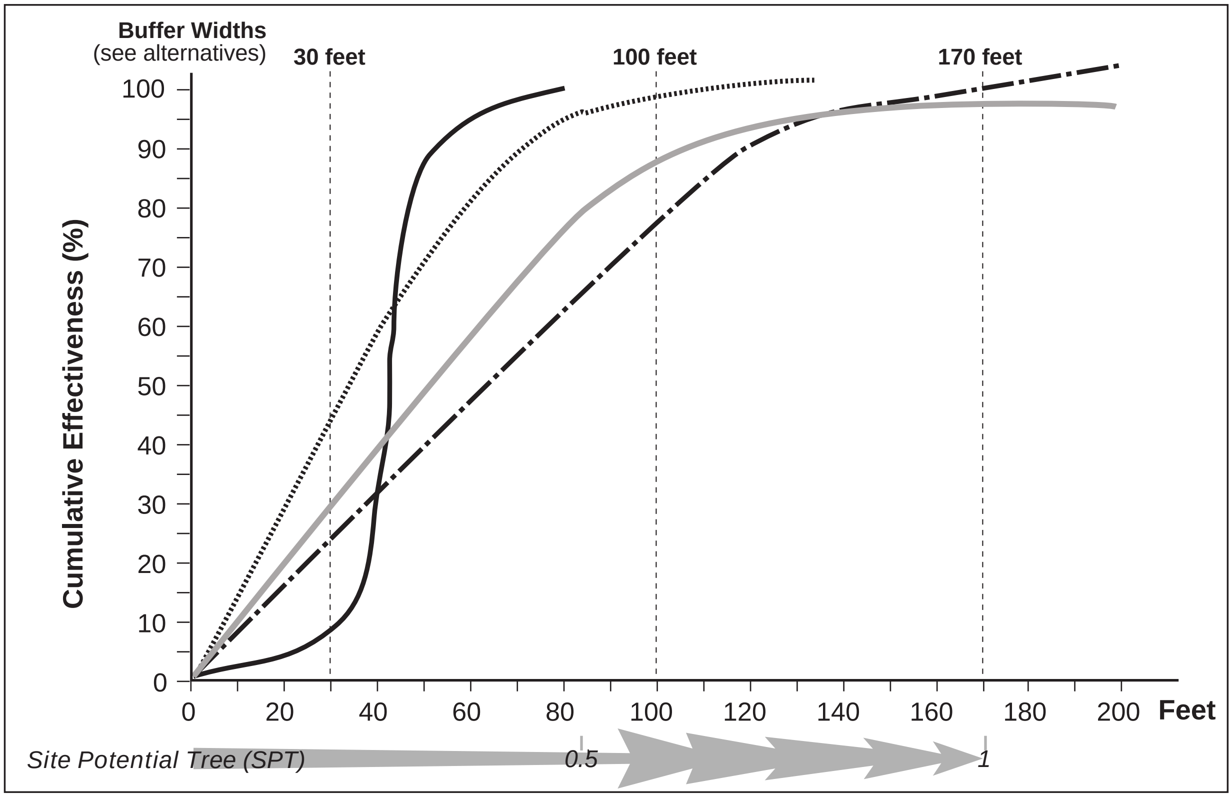
The amount of time needed for riparian areas to produce LWD after harvest depends upon the size of the stream. Measurable contributions of wood from second-growth riparian areas did not occur until 60 years after harvest for third-order channels on the Olympic Peninsula in Washington (Grette, 1985). Bilby and Wasserman (1989) indicate that it takes longer than 70 years for streamside vegetation to provide stable material to streams wider than 50 feet in southwestern Washington. Murphy and Koski (1989) indicate that post- harvest LWD recruitment levels have relatively long recovery rates of up to 250 years in southeast Alaska. Therefore, larger streams are likely to be deficient in LWD for longer periods after timber harvest than smaller streams (MacDonald et al., 1991).

In addition to the amount of LWD input, the species of LWD contributed is also important. Coniferous LWD significantly outlasts deciduous LWD in the stream system (Harmon et al., 1986; Grette, 1985). Simply setting aside buffers of second-growth hardwoods does not provide optimal LWD input over the short term, because unassisted recovery of these areas to pre-logging coniferous LWD recruitment levels may take 100 to 200 years.

Although the specific role of lower-order streams in LWD input to downstream areas is not completely understood, these streams are known to supply some LWD to higher-order streams (Potts and Anderson, 1990). LWD input in these steams plays a role in stabilizing existing debris and sediment to prevent debris flows that affect downstream fisheries habitat.

Leaf and Needle Litter (Detritus Production)

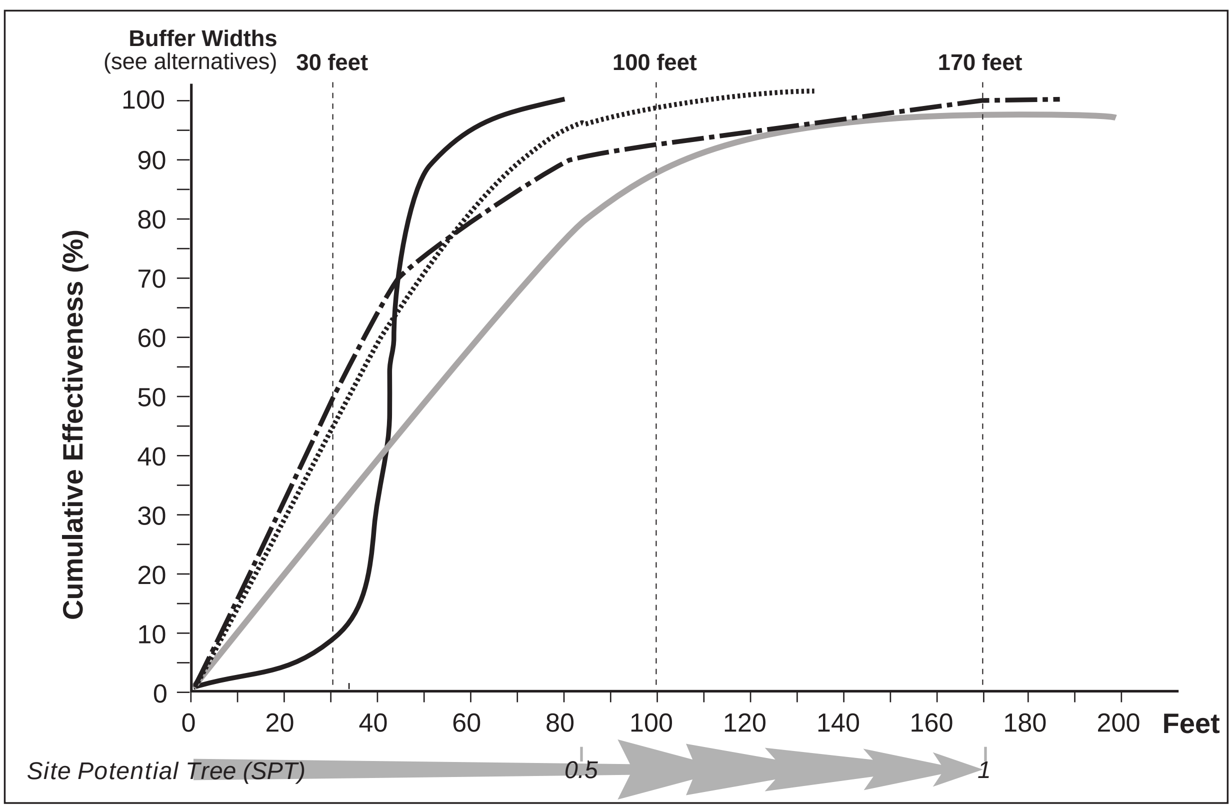
Stream and benthic communities (e.g., aquatic insects) are highly dependent on detrital inputs. Detritus is defined as all dead organic carbon, distinguished from living organic or inorganic carbon (Wetzel, 1975). With respect to stream systems, detritus has two forms: (1) originating within the stream (autochthonous); and (2) originating outside the stream



Source: FEMAT, 1993

Figure 3.7-2a.

The Percent Effectiveness of Shade in Relation to the Distance from the Stream Channel



Source: McDade et al, 1990

Figure 3.7-2b.

The Percent Effectiveness of Coarse Woody Debris in Relation to the Distance from the Stream Channel (allochthonous). The primary form of autochthonous detritus is dead algae and other aquatic plant material. In small, forested mountain streams, autochthonous detritus accounts for only a small portion of the total detrital input within the system. Allochthonous detritus is the primary source of detrital input into small and medium streams through the annual contribution of large amounts of leaves, cones, wood, and dissolved organic matter (Gregory et al., 1991; Richardson, 1992). The importance of this type of detrital input varies among streams, but can provide up to 60 percent of the total energy input into stream communities (Richardson, 1992).

Allochthonous detritus enters a stream primarily by direct leaf or debris fall, although organic material may also enter the stream channel by overland flow of water, mass soil movements, or shifting of stream channels. Few studies have been done relating litter contributions to streams as a function of distance from the stream channel; however, it is assumed that most fine organic litter originates within 98.4 feet or approximately 0.5 tree height from the channel (FEMAT, 1993) (see Figure 3.7-2c). In deciduous woodlands, windborne leaf litter may travel farther from source trees than needles or twigs from coniferous vegetation. Therefore, riparian buffers in these woodlands may have to be wider than in coniferous forests in order to protect natural levels of organic inputs. In most cases, however, buffers designed to protect most LWD recruitment would likely ensure nearly 100 percent of allochthonous detritus (Spence et al., 1996). Spence et al. (1996) concluded that a buffer width of 0.75 of a site-potential tree height is needed to provide full protection for litter inputs.

Forest practices can lead to changes in leaf litter distribution and dynamics in upland and riparian areas, which in turn affect availability in streams. Harvest intensity (i.e., the proportion of forest canopy removed) and cutting frequency affect the rate of nutrient removal from the system (Beschta et al., 1995). Stand age significantly influences detrital input to a stream system. Allochthonous detrital input was estimated to be two times as high in old-growth forests as in either 30- or 60-year-old forests (Richardson, 1992) and could be as much as five times as high in old-growth forests as in clearcut forests (Bilby and Bisson, 1992). However, reduced levels of allochthonous detrital input into streams due to streamside timber harvest is somewhat offset by concomitant increases in autochthonous detrital production. Reduced riparian forest canopy increases light levels and, therefore, algae production. The abundance and composition of detritivore (macroinvertebrates that process detritus) assemblages in streams are determined largely by the plant composition of riparian zones (Gregory et al., 1991). Therefore, the macroinvertebrate composition may be altered by changing the stand composition.

An important long-term effect of clearcut logging is potential overshading from second-growth canopy. Second-growth vegetation produces a denser shade and lacks the canopy gaps that are common in old-growth forest. Thus, increased stream production in the first 20 years after timber harvest may be followed by a much longer period of depressed production (Murphy, 1995).

Streambank Stability

The roots of riparian vegetation help bind soil together; this makes streambanks less susceptible to erosion. Riparian vegetation can also provide hydraulic roughness elements that dissipate stream energy during high or overbank flows, which further reduces bank erosion. In most cases, vegetation immediately adjacent to a stream channel is most important in maintaining bank integrity (FEMAT, 1993); however, in wide valleys with shifting stream channels, vegetation throughout the floodplain may be important over longer periods. Although there are limited data quantifying the effective zone of influence relative to root strength, FEMAT (1993) concluded that most of the stabilizing influence of riparian root structure is probably provided by trees within 0.5 of a potential tree height of the stream channel (see Figure 3.7-2d). With respect to the northern California coast, however, it is important to note that redwoods, the dominant conifer along many streams, resprout following harvest (SYP, Appendix K). As a result, decreases in root strength may be lower than in the reviewed studies (SYP, Appendix K).

The percentage of redwoods that resprout after harvest varies and is related to the age and vigor of the trees harvested (Olson et al., 1990). Oliver (1994) found that 69 percent of all redwoods resprout after harvest, whereas Olson (1990) found 90 percent of redwoods resprouted in a 40-year-old stand. No current publications indicate how much root dieback occurs once a redwood has been harvested or when resprouting takes place. An unpublished study by Lewis (1987) indicated that live root biomass does not dieback immediately upon the cutting of redwoods. The root biomass declines for 11 years before regrowth of roots increases towards prelogging levels in redwoods that resprout. Total root biomass in redwoods, which includes live and dead roots, declines after cutting. Smaller roots (less than 25 mm fraction) take well over 25 years to recover to prelogging levels, and larger roots take longer. In the same study, mixed conifer stands had more-rapid root dieback than did redwood stands. Although the contribution of root strength in harvested redwood forests has not currently been quantified, presumably some decrease of root strength from forested conditions would occur over the short term (10 years). Similar to slope stability influenced by root dieback, the period of maximum potential streambank instability is from 5 to 11 years.

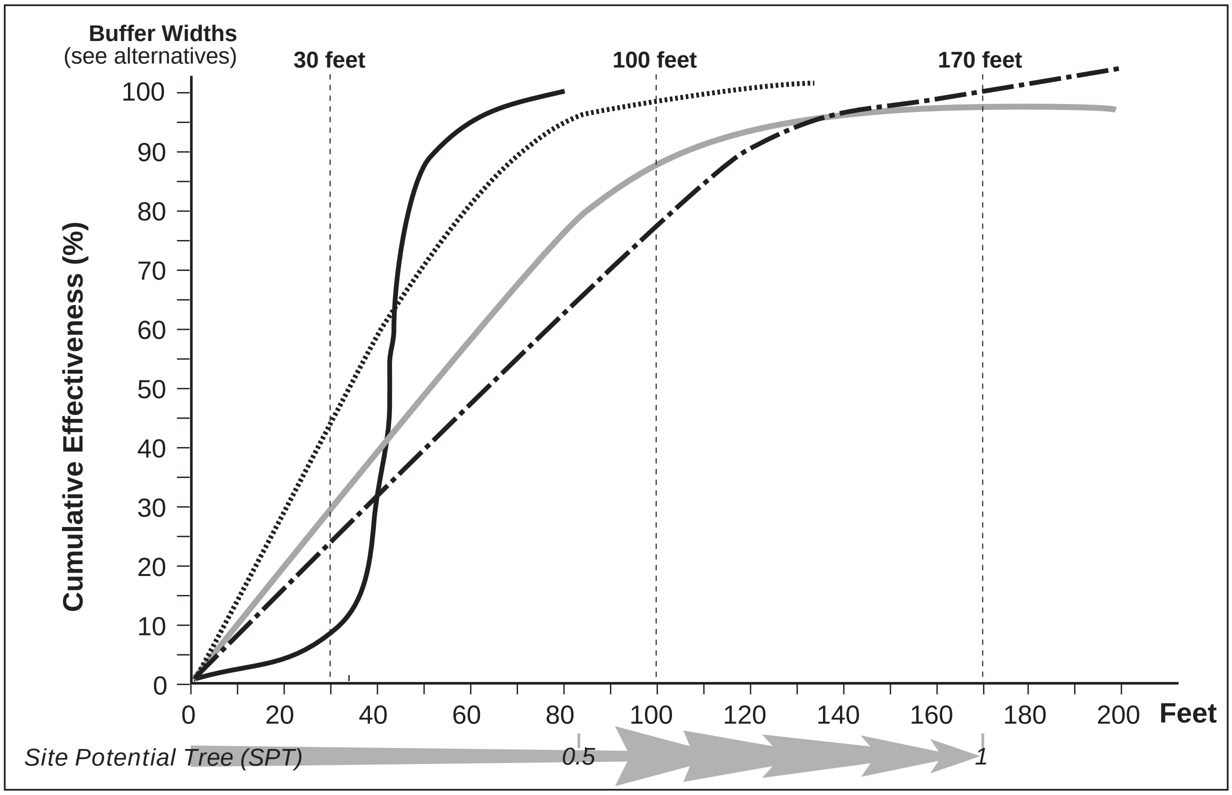
Composition of riparian species within the area of influence differs due to variations in the root morphology of conifers, deciduous trees, and shrubs. Specific relationships between root types and bank stabilization have not been documented; however, if the purpose of riparian protection is to maintain or restore natural bank characteristics, then retaining natural species composition is a reasonable target for maintaining the bank stabilization function of riparian vegetation (Spence et al., 1996).

For additional discussion on bank stability, see Channel Condition in Section 3.4. Overall, buffer widths for protecting other riparian functions (e.g., LWD recruitment and shading) are likely adequate to maintain bank stability if they are maintaining most of those functions.

Sediment Control

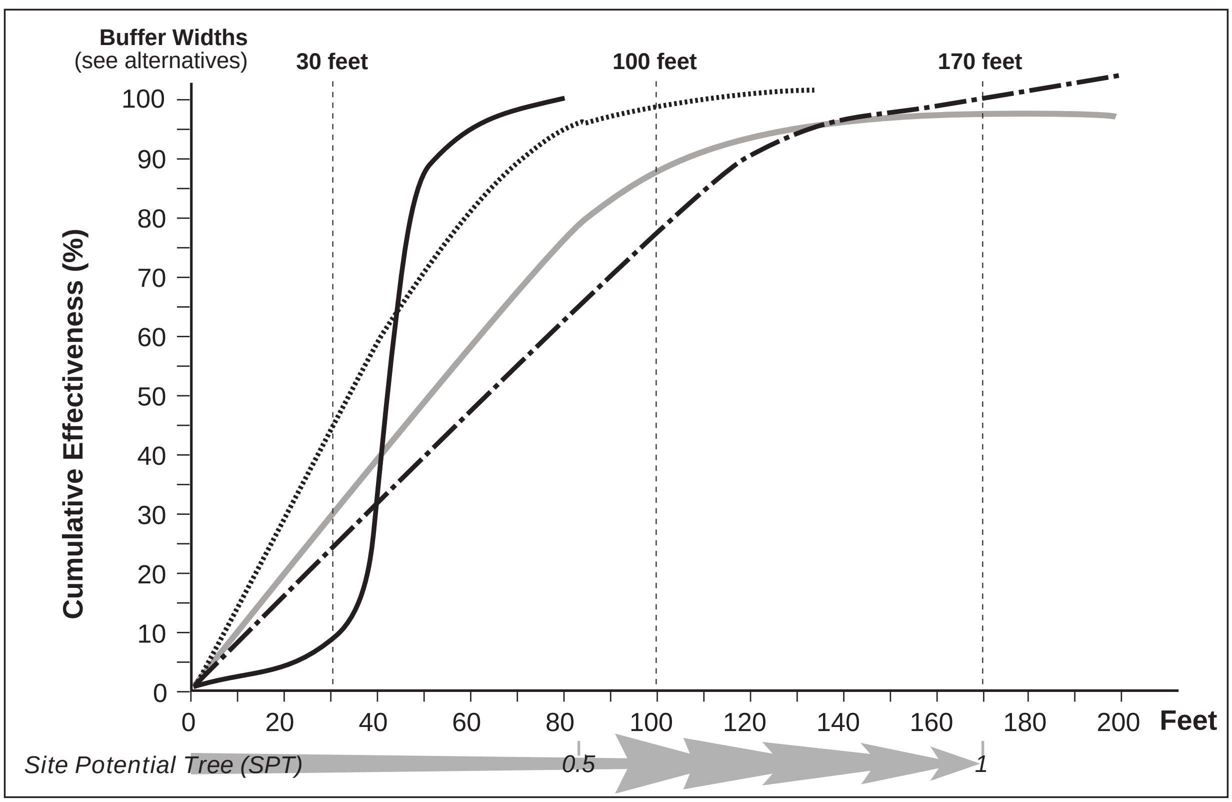
Timber harvest activities often alter watershed conditions by changing the quantity and size distribution of sediment. These alterations can lead to stream channel instability, pool filling by coarse sediment, or introduction of fine sediment to spawning gravels. Factors influencing the delivery of excessive sediment to a stream are discussed in Section 3.6.

The delivery to streams of fine sediment that has been transported overland can be reduced significantly by streamside buffer strips. The ability of riparian buffer strips to control sediment inputs from surface erosion depends on several site characteristics, including the presence of vegetation or organic litter, slope, soil type, and drainage characteristics. These factors influence the ability of buffer strips to trap sediments by determining the infiltration rate of water and the velocity of overland



Source: FEMAT, 1993

Figure 3.7-2c.
The Percent Effectiveness of Litter Fall in Relation to the Distance from the Stream Channel



Source: FEMAT, 1993

Figure 3.7-2d.
The Percent Effectiveness of Root Strength in Relation to the Distance from the Stream Channel

flow. Buffer strip width is an important parameter for evaluating the ability of a management activity to avoid excessive fine sediment delivery to a stream. Recommended buffer widths for sediment removal vary widely (Johnson and Ryba, 1992), ranging from 9.8 feet for removing coarse fractions (sand) to 400.3 feet for fine fractions (clay). Recommended buffer widths cluster around 100 feet. FEMAT (1993) concluded that buffers of approximately one site-potential tree were probably adequate to control sediments from overland flow.

Riparian protection measures must also include practices for minimizing sediment contributions from outside the riparian area (see Section 3.6). In addition, activities within the riparian zone that disturb or compact soils, destroy organic litter, remove large down wood, or otherwise reduce the effectiveness of riparian buffers as sediment filters should be avoided (Spence et al., 1996).

Microclimate

Important components of the microclimate in a forested area include solar radiation, soil temperature, soil moisture, air temperature, wind velocity, and air moisture or humidity (Chen, 1991; Chen et al., 1992). Chen's (1991) data showed the following depth-of-edge effects: 100- to 295-foot penetration depths for solar radiation, soil temperature, and soil moisture; 590 to 787 feet for air temperature; and more than 787 feet for wind velocity and air moisture. These effects, however, are site-specific and vary with edge orientation and weather conditions (Chen, 1991). Chen's studies also compare microclimate gradients among clearcut, edge, and interior forest and do not specifically examine riparian microclimate. Changes in microclimatic conditions within the riparian zone resulting from removal of adjacent vegetation can, however, influence a variety of ecological processes that may affect the long-term integrity of riparian ecosystems (Spence et al., 1996).

Few studies have been done on the relationship between buffer width and riparian microclimate. Ledwith (1996) examined the relationship among buffer widths, air temperature, and relative humidity in the Mad River Ranger District, Six Rivers National Forest, California. He found that air temperature above a stream increased with decreasing buffer widths. The most significant change occurred between 0 and 100 feet. Relative humidity was inversely proportional to air temperature, with the most significant drop also occurring between 0 and 100 feet. Both parameters had continuous, but less dramatic, changes between the 100- and 492-foot buffer width sampling sites. To avoid significantly altering the microclimate of a riparian zone, Ledwith (1996) recommends leaving buffer strips more than 100 feet wide. Buffer strips wider than 100 feet would still affect the microclimate, but at a lower rate of change (Ledwith, 1996).

Brosofske et al. (1997) found riparian microclimatic gradients existed for air temperature, soil temperature, surface air temperature, and relative humidity. Pre-harvest gradients approached upland forest interior values within 31 to 47 meters from the stream, although surface temperature and humidity gradients often extended further (31 to 62 meters). Harvesting interrupted or eliminated the riparian microclimatic gradients. As a result, the riparian microclimatic gradients, after harvest, approximated clearcut values instead of the pre-harvest forest interior gradients. The study indicated that harvest buffers at least 45 meters wide on each side of the stream are needed to maintain an unaltered microclimatic gradient near streams. This study indicated that riparian microclimate can be influenced by activities that occur in the watershed outside of the buffered area. Selective harvest instead of clearcutting in upland areas near small streams could help increase the effectiveness of the buffer. Consequently many standard buffer widths currently in use may not effectively protect the full riparian and transitional microclimate.

FEMAT (1993) presented generalized curves relating protection of microclimatic variables relative to distance from stand edges into forests. These curves suggest that buffers have to be extended an additional one-to-two tree heights outside of the riparian zone to maintain natural levels of soil moisture, solar radiation, and soil temperature within the riparian zone, and even larger buffers (up to three tree heights) to maintain natural air temperature, wind speeds, and humidity (see Figure 3.7-2e). The recommendations of FEMAT (1993) were based on studies in upland forests in the Cascade Mountains of the Pacific Northwest (Chen, 1991). Their applicability to riparian zones is uncertain, particularly in zones within redwood forest on the northern coast of California. Therefore, additional research is needed on buffer widths that are likely to protect microclimate in riparian zones (Spence et al., 1996).

3.7.4.2 Historical Setting for Evaluating the HCP and Alternatives

The review in the preceding section provides a framework for assessing the relative protection afforded specific riparian processes by different riparian management guidelines. Before evaluating the different alternatives, it is important to place the riparian condition discussed in Section 3.7.4.1 into a historical context.

The current riparian habitat conditions in the region of the HCP have been shaped by over 100 years of timber harvest, as well as recent floods, such as the 1964 floods, which reshaped most of the stream channels in the Humboldt area. It is well documented that a considerable portion of riparian ecosystem has been altered or lost since the mid-1850s.

Logging on both public and private lands has left a legacy of altered habitats that still require considerable time for recovery, and the return to historical conditions will probably never occur on a large proportion of the forest landscape. Timber harvest practices were not regulated in riparian zones until the 1970s; thus, there were more then 120 years of human activity and 50 to 70 years of intensive harvest before mandated consideration of streamside protection. Forest practices that contributed to the decline of riparian habitat include timber harvest to streambank; railroad and road building along the riparian corridors; and splash damming. Additionally, removal of LWD was a biologically recommended practice until the mid-1970s. All of these practices led to a considerable reduction in riparian zone function.

Recent Floods

A series of six large floods occurred in the planning area from 1950 to 1975. One flood in particular, the historic flood of December 1964, caused extensive landsliding and gullying, particularly on harvested land (Kelsey, 1980; Janda, 1978) (see Section 3.4). The combination of unusually high flow events and large inputs of sediment of all sizes produced substantial changes in stream channels that persist to the present in some areas. Channels aggraded up to 12 feet and widened as much as 100 percent (Hickey, 1969; Kelsey, 1980; Lisle, 1981a) (see Section 3.4). Channel courses were changed and many became braided. As a result, riparian corridors were stripped, and large volumes of woody debris were introduced by landslides and eroding banks.

Figure 3.7-2e. The Percent Effectiveness of Microclimate in Relation to the Distance from the Stream Channel. This figure is currently being digitized.

temperatures. Since that flood, newly formed banks and riparian vegetation in some stream channels have remained vulnerable to erosion at high flows (Sullivan et al., 1987). The absence of large floods since 1975 and 1986 (depending on the WAA) has helped to stabilize channel conditions so that riparian stands are increasingly less vulnerable to high flows. Most small channels have recovered to the point where riparian trees are reestablished and new debris is accumulating. This riparian vegetation has assisted in the reconstruction of banks by trapping and stabilizing fine sediment. The more recent 1996 "New Years Day" flood was also considered significant by many and demonstrated the susceptibility of some drainages and riparian areas to catastrophic storm events.

Federal and State Forest Practices in Maintaining Riparian Functions

In the 1970s, guidelines for forest practices began to address management prescriptions for riparian protection more specifically. On federal lands (e.g., BLM and USFS), riparian management was ad dressed directly in the planning process by developing resource management plans and individual standards and guidelines. The FPA developed riparian prescriptions

Riparian vegetation in widened channels became more isolated from streams in summer, resulting in increased stream for private forest lands at about the same time (Table 3.7-10). These relatively recent federal and state land use regulations were designed to protect riparian zone functions as understood at that time.

The federal land management prescriptions and FPRs define the width of riparian management zones and allowable activities within the riparian zone based on water-type classifications (see Section 3.7.3.1). The federal strategies allow timber harvest and other activities within the RMZ only when such activities will not compromise the riparian management objectives or if such activities are needed to attain these objectives. FPRs allow greater activity within the RMZ. State FPRs seek to protect riparian shading and LWD recruitment through retention of a percentage of overstory and understory vegetation and a specified number of trees per length of stream (see Table 3.7-10). These rules also target sediment control by maintaining 75 percent of the ground cover near streams. FPRs allow increases or decreases in riparian management zone width and canopy retention requirements based on site characteristics or proposed forestry practices, provided they do not degrade beneficial uses. These changes must be approved by the Director of CDF.

FPRs for riparian management have been in force for approximately 20 years. As a result, it can be assumed that the riparian zones are growing back and are at some level of recovery. Some of these riparian zones are likely reaching advanced stages, while others are still reestablishing themselves (see Table 3.7-8). Riparian zones under these management practices have likely had some improvement in areas where previous practices allowed for more extensive harvest in riparian zones. The intent of WLPZs was to minimize impacts on riparian function as long as they protected beneficial uses of the water, not to provide complete protection for all riparian functions.

The Northwest Forest Plan was adopted in 1994, on National Forest and BLM lands within the range of the spotted owl (which overlaps all of PALCO's land). The Plan increased protection of riparian resources with the implementation of riparian reserves and the aquatic conservation strategy (Table 3.7-10). With the recent listing of coho salmon, CDF has developed guidelines to consider for timber harvest under the FPRs (*Coho Salmon Considerations for Timber Harvesting Under the California Forest Practice Rules* [CDF, 1997b]). These coho considerations provide guidance for conservation measures for timber operations within the ESUs where coho salmon are listed (see Section 3.8). Their main purpose is to avoid significant modification or degradation of coho salmon habitat during timber harvest. In riparian areas, the emphasis of conservation measures for coho salmon habitat from timber harvest is on retention of vegetative features to assure LWD recruitment, maintenance of desired stream temperature, protection of important channel and bank character, and buffering from upland erosion (CDF, 1997b).

The Proposed HCPs

HCPs are being developed in the region under FESA. The plans are examples of new management approaches tailored to species-specific requirements found in the region. HCPs that cover aquatic and semi-aquatic species usually include streamside buffers that provide the full range of riparian functions (LWD, shade, nutrients, sediment filtering, bank stability, and microclimate). Once HCPs are approved by NMFS/FWS, the landowners are assured that management of their lands will not be disrupted by new regulations or restrictions for those species covered.

Table 3.7-10. Riparian Prescriptions[1/] Related to Various Federal and State Agencies, California FPRs, and PALCO HCP

Source	Stream Classification	Class I	Class II	Class III
California 24 FPR 916.5 (936.5, 956.5)	Definition	Fish always or seasonally present, fish spawning or migration habitat, or a supply of domestic water.[2/]	Fish always or seasonally present within 1,000 feet downstream of habitat for non-fish species or aquatic habitat for non-fish aquatic species.[2/]	No aquatic life present; capable of sediment transport.[2/]
	WLPZ Width (ft)[3/]	75 to150-foot buffer based on slope.[4/]	50 to 100-foot buffer based on slope[5/]	Determined on a site-specific basis.
	Stream Shade	Retain 50% overstory and 50% understory canopy covering ground; retain 25% overstory conifers.	Retain 50% of total canopy covering the ground. Retain 25% of the existing overstory conifers.	50% of total understory vegetation shall be left.
	Tree Retention/LWD Recruitment	Minimum 2 live conifers >= 16 inches dbh and 50-foot tall per acre within 50 feet of stream. Also recruitment potential from trees retained for shade.	Recruitment potential from trees retained for shade.	Not specified.
	Sediment Filtering	75% of ground cover must remain undisturbed.	Same as Class I.	Same as Class I.
Northwest Forest Plan (Forest Service and Bureau of Land Management)	Definition	Fish bearing.[6/]	Non-fish bearing (perennial).[6/]	Non-fish intermittent.[6/]
	RR Width (ft)[7/]	340-foot no-harvest buffer[7/] or 2 site-potential trees (SPT).[8/]	150-foot no-harvest buffer[7/] or 1 SPT.[9/]	100-foot no-harvest buffer[7/] or 1 SPT.[9/]
	Stream Shade	No specific stream shade requirements; shade protected through large riparian reserves. No harvest in reserves except when riparian conservation objectives are not adversely affected.	Same as Class I.	Same as Class I.
	Tree Retention/LWD Recruitment	Provided through RR width (see above).	Same as Class I.	Same as Class I.
	Sediment Filtering	Protection provided through the establishment of no-harvest buffers (see RR width).	Same as Class I.	Same as Class I.

Source	Stream Classification	Class I	Class II	Class III
PALCO HCP	Definition	Fish always or seasonally present, fish spawning or migration habitat, or a supply of domestic water.[2/]	Fish always or seasonally present within 1,000 feet downstream of habitat for non-fish species or aquatic habitat for non-fish species.[2/]	No aquatic life present; capable of sediment transport.[2/]
	RMZ Width (ft)[10/]	170 feet based on[12/] slope distance.	100 to 130 feet.[13/]	25- to 50-foot ELZ[11/] or 100-foot EEZ.[11/]
	Stream Shade	0- to 100-foot no-harvest buffer. Average of at least 80% overstory conifer canopy closure; outer band selective harvest (WHR6) not reduced below 80%.	0- to 30-foot no-harvest. Outer band WHR6, not reduced below 80%.	No specific provision for shade.
	Tree Retention/ LWD Recruitment	0- to 100-foot no-harvest buffer; 100 to 170 feet selective harvest; (240-square-foot residual basal area/acre post harvest). No removal of LWD from 0 to 100 feet; limited removal 100 to 170 feet.	0- to 30-foot no-harvest. Outer band (30-100 or 130 feet) selective harvest (240-square-foot residual basal area/acres post-harvest). No removal of LWD from RMZ or EEZ.	All downed trees are not removed and the steeper the slope the greater the zone (widths match ELZ and EEZ). [11/]
	Sediment Filtering	Protection provided through stream buffers and silvicultural prescriptions (see RMZ width), EEZ; full suspension yarding; treatment of exposed mineral soils in RMZ; must maintain downed wood; for slopes greater than 50% selective harvest expanded to break in slope.[12/]	Same as Class I. In addition sediment filtration band in slopes less than 50%.[13/]	Same as Class III under tree retention/LWD recruitment.

1/ NMFS and cooperating agencies (e.g., EPA, USFS, and state agencies [CDFG, CDF]) have developed a habit conditions matrix that assess as aquatic habitat on PALCO's land. It includes criteria for a properly functioning riparian area.

2/ Based on California Forest Practice Rules.

3/ Water course and lake protection zone measured in slope distance.

4/ Buffers established: Class I < 30% = 75 feet, 30-50% = 100 feet, >50% = 150 feet.

5/ Buffers established: Class II: 6/< 30% = 50 feet, 30-50% = 75 feet, >50% = 100 feet.

6/ Based on Northwest Forest Plan stream classification.

7/ Riparian Reserve measured in slope distance.

8/ No-harvest buffer (slope distance) or within an area equal to the height of two site-potential trees, whichever is greater. Wetlands over 1 acre have a no-harvest buffer of 150 feet (slope distance).

9/ No-harvest buffer (slope distance) or within an area equal to the height of one site-potential tree, whichever is greater. 100-foot no-harvest buffer on wetlands greater than 1 acre.

Source	Stream Classification	Class I	Class II	Class III

10/ RMZ measured in slope distance.

11/ Timber harvest allowed but ELZ and EEZ vary with slope and yarding method (<30% = 25 feet ELZ, 30-50% = 50 feet ELZ, >50% 100 feet EEZ).

12/ First 100 feet of Class I streams are no-harvest. From 100 to 170 feet is an EEZ with a selective harvest every 20 years target WHR6 silvicultural prescription. For slopes greater than 50% this prescription may be more restrictive and likely implemented to break in slope or distance determined by mass wasting team (which could be more or less distance than the designated 170 feet).

13/ First 30 feet of Class II streams are no-harvest for all timber types and sideslopes. From 30 to 130 feet outside the Humboldt WAA and 30 to 100 feet inside the Humboldt WAA is an EEZ, and selective harvest every 20 years target WHR6 silvicultural prescription. For slopes greater than 50% adjacent to the RMZ, the hill slope management mass-wasting process will be implemented to the break-in-slope or to a distance determined by the mass-wasting team (the minimum prescription would be to continue a WHR6 silvicultural prescription to the break-in-slope). For all slopes less than 50% adjacent to the RMZ, a sediment filtration band shall be established from 130 to 170 feet.

Source: Foster Wheeler Environmental Corporation

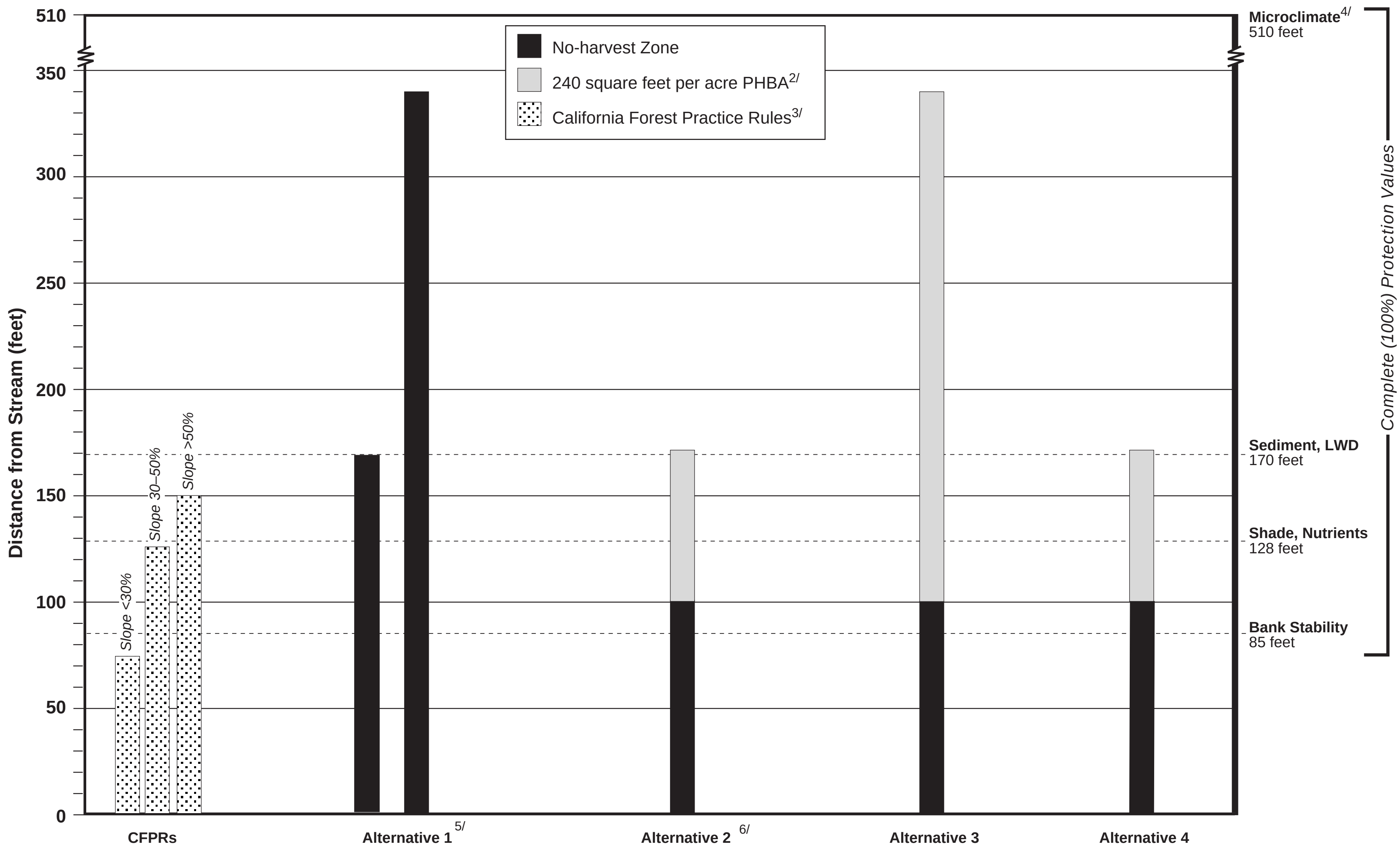
PALCO has developed a number of HCP measures directed at riparian areas and has implemented some of these measures. Any THPs submitted after February 1998 have incorporated interim strategy prescriptions (see Appendix E). Other measures represent new management commitments that would be implemented upon approval of the HCP and ITP. The proposed HCP seeks to provide more protection of riparian function along Class I, II, and III streams than is currently found under FPRs (Table 3.7-10 and Figures 3.7-3a, b, and c). However, FPRs apply when PALCO's proposed HCP is less restrictive. PALCO's proposed HCP seeks to improve riparian shading, LWD recruitment, bank stability, sediment filtration, leaf litter input, and some components of the microclimate. These improvements would occur through a designated no-harvest band on all Class I and Class II streams, and late seral prescription single-tree selection that maintains WHR 6, 5M, or 5D (see Section 3.9) on the OBs of Class I and II streams (see Section 2.5 for details regarding riparian prescriptions). For a breakdown of trees by size class on Class I and II streams, see Appendix Table J-1 and Appendix Figures J-1a and b. This evaluation provides an example of the number of trees that would be left per 100 feet of stream length in the harvest portion of stream buffers proposed by PALCO in a mature (60-year-old) stand based on the percentage of residual basal area to be left using the target percentages by diameter class found in Appendix J, Attachment J-1. This modeled stand is used for comparative purposes. The site class and timber type found within a site-specific RMZ will determine whether more or fewer trees of different size class distributions occur in an individual 60-year-old stand.

PALCO would also analyze the watersheds within the proposed HCP boundaries to develop watershed-specific measures for aquatic function. This analysis will be based on modifications of procedures developed by the Washington State Department of Natural Resources (1997). Watershed analysis identifies areas that need additional protection beyond the standard requirements. Protection of non-fish-bearing streams is targeted for control of sediment and high water temperature delivery downstream to fish-bearing streams. At this time, however, no studies are available that document a significant difference in the adequacy of prescriptions from watershed analysis to protect riparian and, thus, aquatic habitat function (Collins and Pess, 1997).

Designing a long-term, ecosystem-based habitat management plan is difficult be cause natural systems are dynamic, and there are always risks and uncertainty when implementing forest management activities. This uncertainty is addressed in the proposed HCP through the ongoing use of trend monitoring and "adaptive management." The concept is implemented in the proposed HCP through a broad program of monitoring, surveys, reporting, and cooperative research which would be used to evaluate the biological relationship and habitat responses to management actions taken in the HCP planning area. Finally, PALCO would incorporate specific measures or a Section 1603 Agreement (PALCO 1998, Volume VI, Part E) into certain types of its proposed activities to minimize and mitigate the effects of those activities on fish and wildlife resources.

3.7.4.3 Evaluation of Alternatives

As discussed in Section 3.7.3.1, most of the riparian landscape appears not to be currently fully functioning. Seral stage classification provides a general picture of riparian conditions and quality. Sixteen percent of the riparian vegetation found in



1/ Areas within reserves will receive complete protection, by default.

2/ Post-Harvest Basal Area (PHBA); see Appendix [FF] for distribution of tree sizes left under these silvicultural prescriptions.

3/ CFPRs stipulate the retention of at least 50% overstory and 50% understory along Class I streams; for purposes of comparison to HCP silvicultural prescriptions, the anticipated PHBA would be less than 240 square feet per acre.

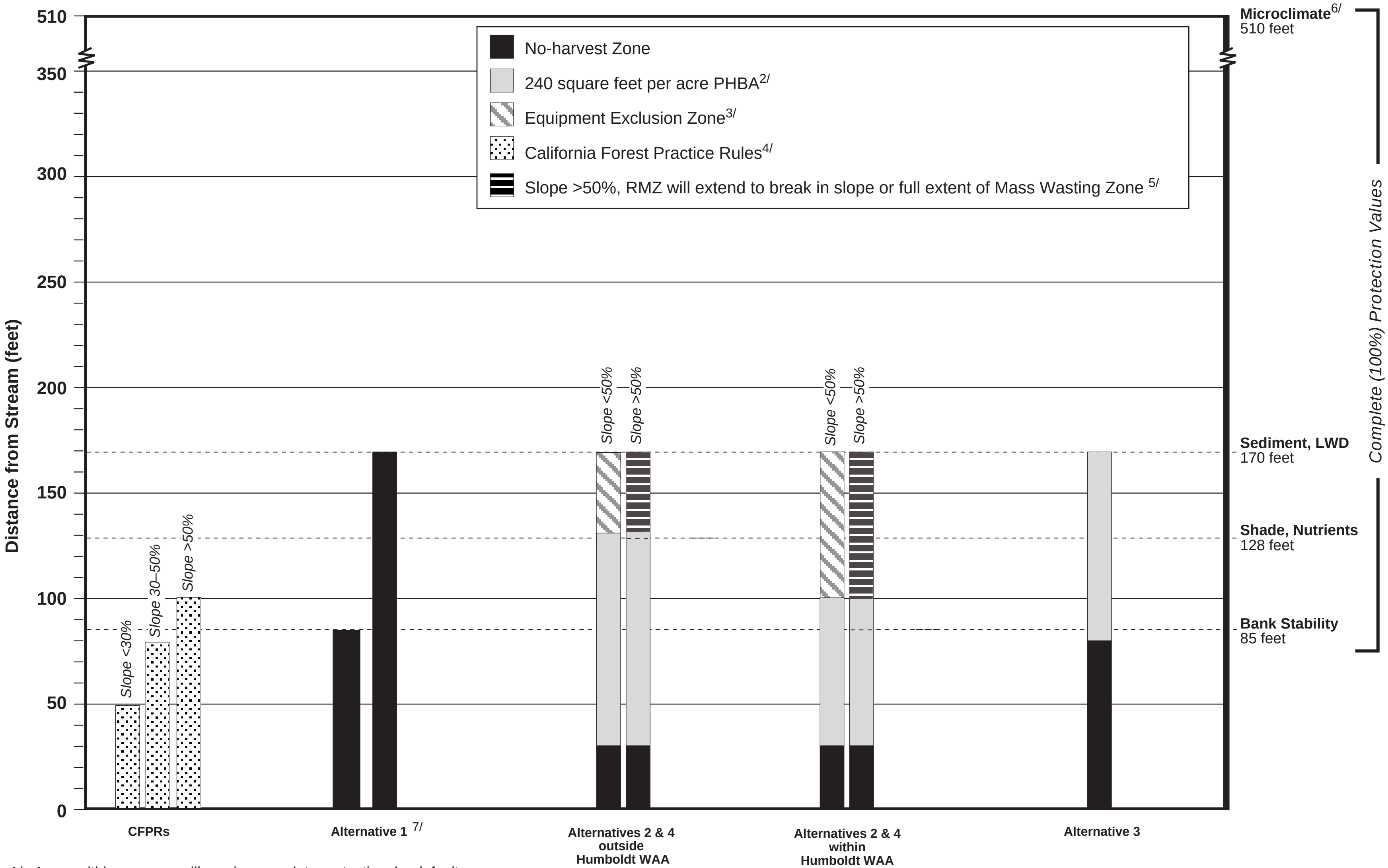
4/ Complete (100%) protection based upon most restrictive component of microclimate, which is humidity (see Figure 3.7-2e).

5/ Class I RMZ widths range between 170 and 340 feet; both ends of the range are represented in this figure.

6/ On slopes greater than 50%, Band 3 is to be extended to break in slope.

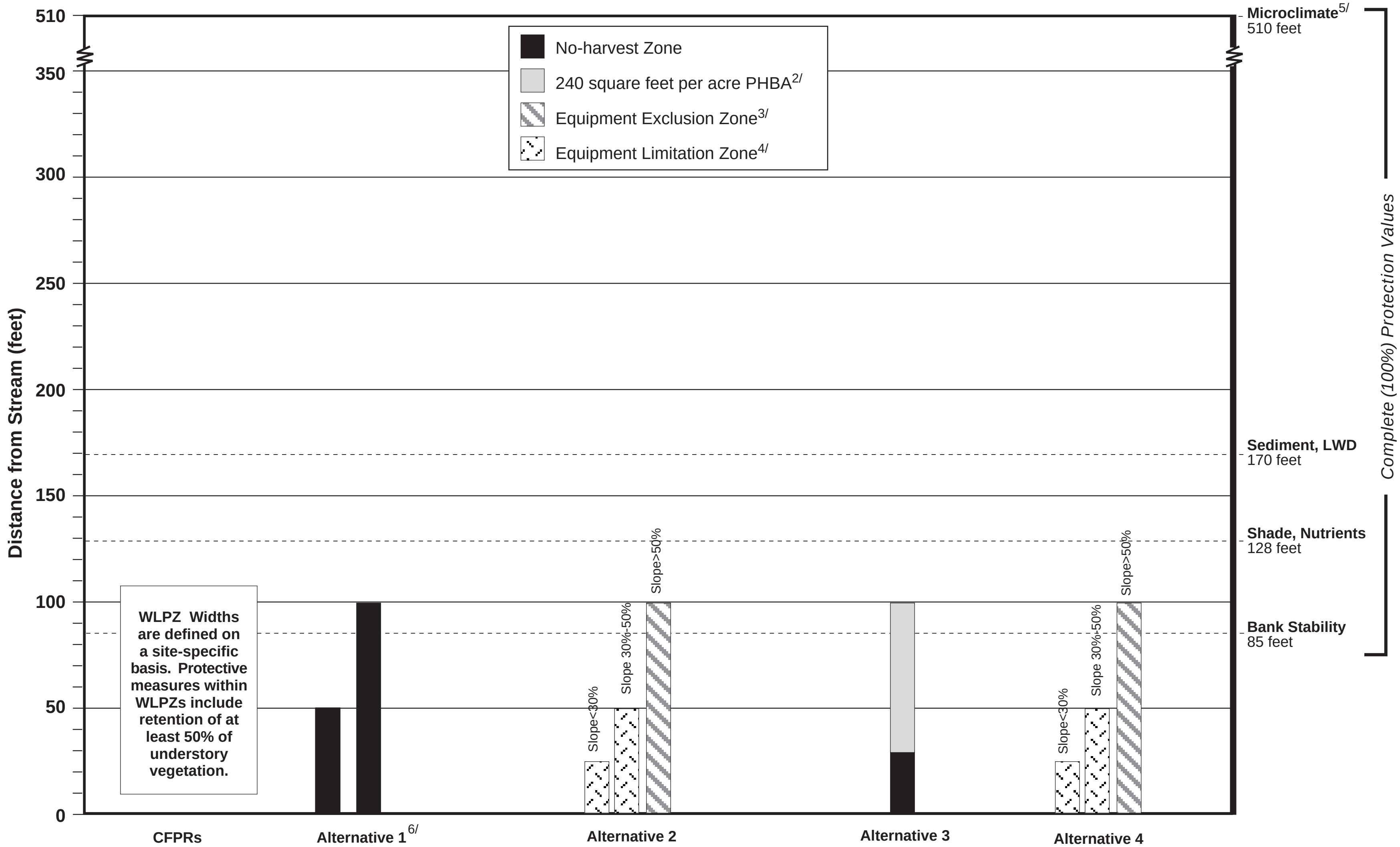
Figure 3.7-3a.

Riparian Management Zone Widths Along Class I Streams Outside of Reserves, by Alternative[1/]



1/ Areas within reserves will receive complete protection, by default.
2/ Post-Harvest Basal Area (PHBA); see Appendix [FF] for distribution of tree sizes left under these silvicultural prescriptions.
3/ The area from which heavy equipment associated with timber harvest operations is totally excluded.
4/ CFPRs stipulate the retention of at least 50% canopy cover along Class II streams; for purposes of comparison to HCP silvicultural prescriptions, the anticipated PHBA would be less than 240 square feet per acre.
5/ A minimum prescription for these areas is 240 sq. ft. per acre PHBA.
6/ Complete (100%) protection based upon most restrictive component of microclimate which is humidity (see Figure 3.7-2e).
7/ Class II RMZ widths range between 85 and 170 feet; both ends of the range are represented in this figure.

Figure 3.7-3b.
Riparian Management Zone Widths Along Class II Streams Outside of Reserves, by Alternative[1/]



1/ Areas within reserves will receive complete protection, by default.
2/ Post-Harvest Basal Area (PHBA) ; see Appendix [FF] for distribution of tree sizes left under these silvicultural prescriptions.
3/ The area from which heavy equipment associated with timber harvest operations is totally excluded.
4/ The area within which heavy equipment associated with timber harvest operations is limited.
5/ Complete (100%) protection based upon most restrictive component of microclimate, which is humidity (see Figure 3.7-2e).
6/ Class III RMZ widths range between 50 and 100 feet; both ends of the range are represented in this figure.

Figure 3.7-3c.
Riparian Management Zone Widths Along Class III Streams Outside of Reserves, by Alternative[1/]

the project area is made up of young open forest and 44 percent is mid-seral forest. Where some level of disturbance has occurred in riparian areas (Table 3.7-8), there would be an extended period attain desirable levels that approach target conditions (Table 3.7-11). For example, in early seral stages, the immature riparian vegetation (both hardwood and coniferous species) is a low-to-moderate shade source and a poor contributor of LWD. In mid-seral stages, the riparian vegetation is a good shade source and a low-to-moderate contributor of LWD. Most riparian vegetation does not become a good source of LWD until the late seral stages. Although much of the land is currently in early to mid-seral stages (Table 3.7-11 and Table 3.7-8), riparian habitat should improve over time (20 to 90 years) to increase healthy riparian areas. Changes in riparian management and their effect on riparian habitat quality will be discussed in short term (10-year) and long-term (50-year) time frames. For each riparian function, the time frame to transition from a non-functional riparian system to one that could provide most riparian functions will also be tracked (see Table 3.7-11).

The alternatives are evaluated in terms of the protection levels provided for shading, LWD recruitment, leaf and needle inputs, bank stability, sediment control, and microclimate. Because each alternative has a different classification scheme and inconsistent leave-tree requirements, it is difficult to compare quantitatively the effectiveness of the different alternatives in protecting riparian functions. Nevertheless, a qualitative sense of the level of protection afforded to specific processes can be gained based on riparian buffer width and the allowable level of activity within that buffer. Figures 3.7-3a, b, and c illustrate the differing buffer widths and protection levels for each stream classification by alternative. To facilitate comparison among alternatives, both fixed buffer widths and site potential tree height are used in the evaluation. A site potential tree height is approximately 170 feet at 100 years for PALCO's ownership. In some cases, however, the redwood zones on PALCO's land can contain site-potential trees in excess of 200 feet at 100 years; consequently, the riparian zones of influence extend farther from the stream channel in these systems.

In Figures 3.7-3a, b, and c, the alternatives are evaluated in terms of the protection provided by shading, LWD recruitment, organic litter inputs, bank stability, sediment control, and microclimate. Riparian buffer widths required to maintain 100 percent of each function are shown on the top of the figure and are based on the review in Section 3.7.4.1. For certain functions (LWD recruitment, shading, and organic litter inputs), site potential tree height is the best yardstick for assessing protection because tree height directly influences these functions. For sediment control, however, absolute width of the buffer and erosion control BMPs may be more important than width relative to site-potential tree height (Spence et al., 1996). Also, the bars shown in Figures 3.7-3a, b, and c should not be construed as representing the percentage of function maintained. In Figure 3.7-2b, for example, most LWD is recruited within 100 feet of the stream channel; consequently, a buffer measuring one-half site-potential tree (85 feet) may provide substantially more than 50 percent function with respect to wood inputs.

To further facilitate comparison among the alternatives, the EBAI was developed. The index was devised as a general assessment of protection of streams relative to riparian management activities. Two components of the EBAI measure buffer effectiveness: (1) sediment filtration and (2) LWD

Table 3.7-11. Percentage of Total Riparian Acres (18,173 acres) Found in the HCP Planning Area by Seral Stage and Estimated Times for Recovery[1/] of Each Riparian Parameter [2/]

Seral Stage[3/]	% Seral Stage	Recovery Periods (in years) Shade	LWD Requirement	Leaf Needle Litter	Streambank Stability	Sediment Filtration	Micro-climate
Forest Openings	2.2	20 to 40+ years	100+ years	40 to 80 years	Functioning to 11 years[6/]	5 years	20 to 40 + years[7/]
Young Forest	14.0	10 to 30 years	100+ years	30 to 70 years	11 years to functioning[6/]	Functioning	10 to 30 + years[7/]
Mid-seral	43.8	20 to functioning[4/]	50 to 100 years	30 to 60 years	Functioning	Functioning	20 years to functioning[7/]
Late-seral	24.4	Functioning	Functioning to 100+ years[5/]	30 to functioning	Functioning	Functioning	Functioning
Old Growth	5.4	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning

1/ Estimated times for recovery are based largely on Gregory and Bisson (1997).

2/ Open natural and grass seral types were not included in recovery projections because they were assumed to remain in the same seral stage over time. Hardwoods were also excluded because it is unknown if they would convert to coniferous forest in the future. Site-specific investigation would be required to determine whether this is a natural condition. These three seral types comprise 10.2 percent of the HCP planning area.

3/ See Section 3.9 for definitions of seral stage.

4/ The upper end of the seral stage size range is functioning. The lower end of the seral stage size range requires more recovery time before meeting function.

5/ Functioning LWD recruitment also depends on stream size for determining recovery. Larger streams require a larger proportion of big trees and, therefore, need a longer period to recover.

6/ As root systems decay after clearcut timber harvest, they still provide functions for several years. The period of time with the maximum potential decrease in root strength is from 5 to 11 years. Tree and root regrowth begins to provide function again about 11 years after clearcut harvest. However, to attain complete function of the finer portion of the root mass can take as much as 25 years.

7/ This is estimated to be the same time frame as shade.

Source: Foster Wheeler Environmental Corporation

recruitment potential. The first component of the index, sediment filtration, is discussed in detail in Section 3.6 (and Appendix I). It is applied in this section as a relative measure of the protection of streams from the accelerated influx of sediment from overland flow from different RMZs. Because the literature usually evaluates buffer widths based on no harvest, and most of the alternatives have some activity within the buffers, the recommended buffer widths in the literature are not directly comparable to those in the alternatives. The sediment EBAI gives consideration to the management activities within the RMZ. The second component of the EBAI is an LWD recruitment potential index that quantitatively measures the potential of each alternative to provide woody debris to Class I and Class II streams. The number for each alternative was determined based upon a recruitment potential index (RPI) coefficient and the number of stream miles in each HU. The RPI coefficient was determined for each stream class based upon silvicultural prescriptions and RMZ widths (see Appendix J for further description of EBAI and data sheets). The results are shown by alternative in Figure 3.7-4 and Table 3.7-12. This portion of the EBAI quantifies the effectiveness of the RMZs at providing LWD recruitment. Both EBAIs were then normalized (EBAI value/stream mile) to ensure comparability in all alternatives, even if the Planning Area varies in size under different alternatives (e.g., Elk River lands are not included in some alternatives, but are included in others).

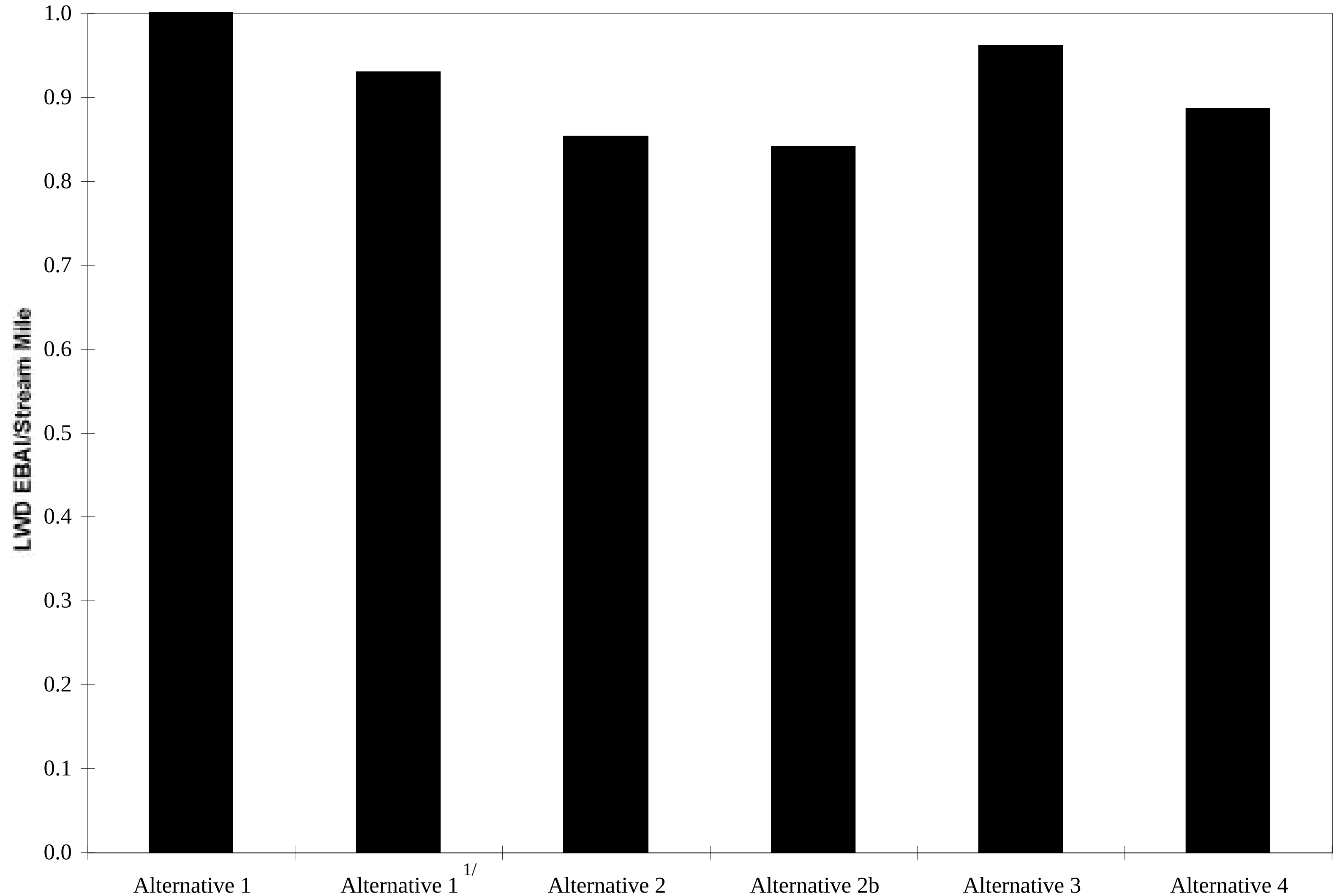
In addition to the EBAI, anticipated effects of the proposed alternatives on riparian habitats included a comparison of estimated changes in total riparian acreage for each alternative based on its different management activities (see Figure 3.7-5). When calculating riparian acres, the GIS measured horizontal distance for Alternatives 1 and 3 and slope distance for Alternatives 2 and 4.

For all alternatives, riparian acres are underestimated in areas where the channel migration zone meander belt is greater than the ordinary high water mark. This is most evident in portions of the Eel River, Larabee Creek, and Yager Creek. For assessment purposes, the existing comparison is sufficient. In Figure 3.7-5, "A" represents the no-cut buffer found in all alternatives not including the reserve lands, but includes the riparian acres protected in marbled murrelet reserves. "B" represents the acres of riparian land available for late seral prescription found in Alternatives 2, 3, and 4. "C" and "D" represent EEZs and ELZs, respectively.

The evaluation of alternatives will focus primarily on forested riparian areas. As a result, this section does not directly evaluate riparian areas and their functions in natural open areas such as grasslands and prairies. Overall, these open areas will receive the same protection as that described in the forested riparian areas. However, management concerns (e.g., timber harvest effects are less important than other uses such as grazing) are not the same in these areas. Grazing is discussed in detail in Section 3.4, and a general discussion of its effects follows.

The RMZs in all alternatives are likely to experience some degree of blowdown or windthrow in localized areas. Windthrow is a normal occurrence in forests, but is known to increase after timber harvest opens formerly interior forest trees to the more direct effects of the wind (Harris 1989). Buffer strips along streams are subject to similar increases in windthrow.

When timber harvest opens a stand to direct wind forces, individual trees or groups of trees may topple. Certain factors increase the vulnerability of a buffer strip to large blowdown events (e.g., tree type,



1/ Analyzed using 170-foot, no-harvest buffers for Class I streams, 85-foot, no-harvest buffers for Class II streams, and soft buffers for Class III streams. In addition, marbled murrelet-occupied, residual stands are not specifically known and are not accounted for in these values.

Figure 3.7-4. Totaled LWD EBAI for Each Alternative

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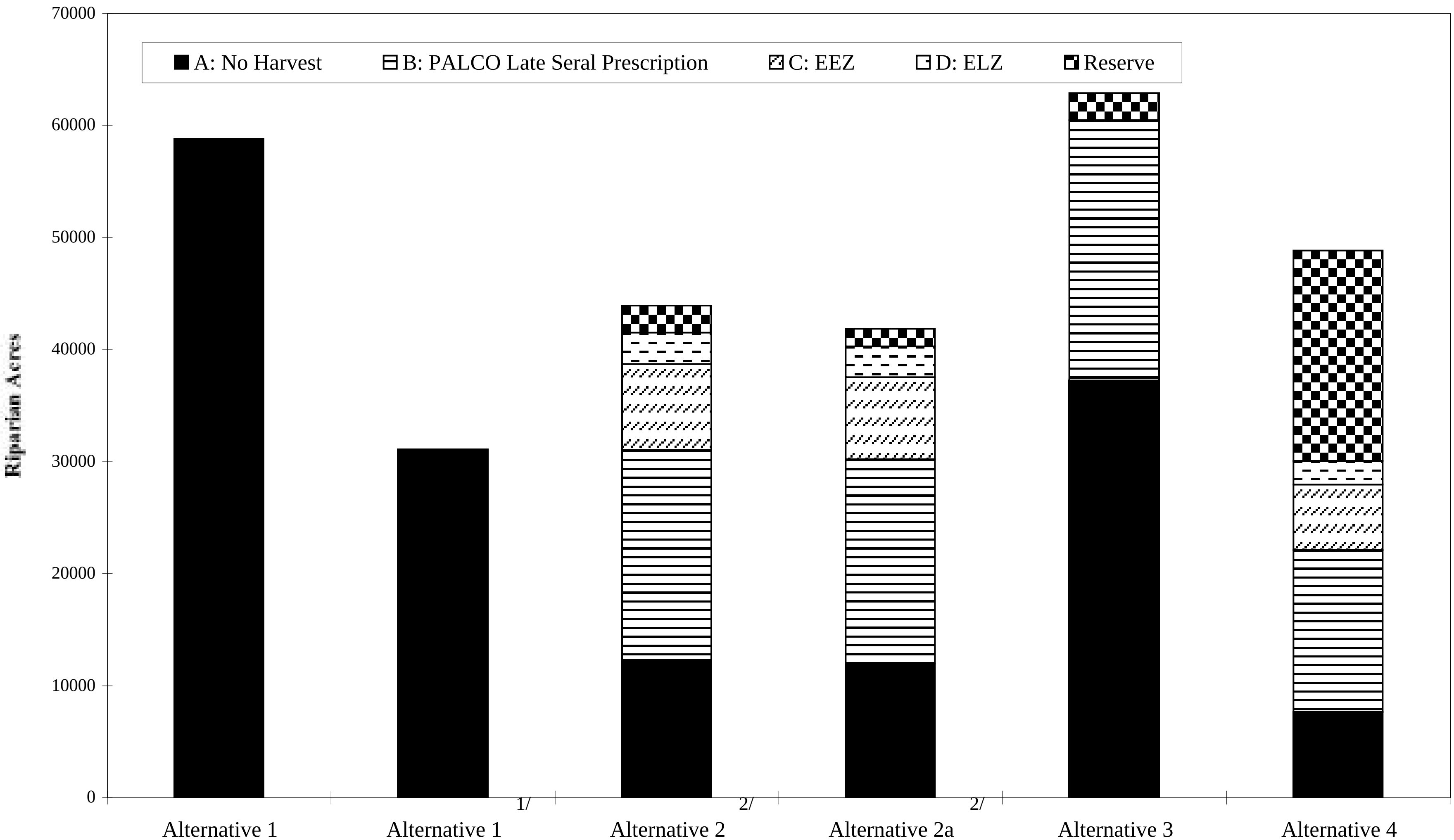
Table 3.7-12. LWD Equivalent Buffer Analysis Index for Each Alternative and Hydrologic Unit

Hydrologic Unit	Normalized EBA (LWD recruitment potential index per stream mile) Alternative 1	Alternative 1 [1/]	Alternative 2	Alternative 2a	Alternative 3	Alternative 4
Bear River	1.00	0.93	0.85	0.85	0.96	0.85
Mattole Delta	1.00	0.93	0.86	0.86	0.96	0.86
NF Mattole River	1.00	0.92	0.84	0.84	0.99	0.84
Upper NF Mattole	1.00	0.92	0.84	0.84	0.97	0.84
Eel Delta	1.00	0.92	0.84	0.84	0.94	0.91
Giants Ave	1.00	0.92	0.83	0.83	0.93	0.83
Larabee Creek	1.00	0.93	0.84	0.84	0.97	0.84
Lower Eel	1.00	0.92	0.83	0.86	0.95	0.83
Sequoia	1.00	0.92	0.84	0.84	0.95	0.84
Elk River	1.00	0.93	0.87	0.84	0.97	1.00
Freshwater Creek	1.00	0.93	0.83	0.83	0.94	0.83
Jacoby Creek	1.00	0.90	0.77	0.77	0.97	0.77
Other HUs	1.00	0.90	0.80	0.80	0.99	0.89
Salmon Creek	1.00	0.93	0.97	0.97	1.00	0.97
Butler Valley	1.00	0.91	0.82	0.82	0.94	0.82
Iaqua Buttes	1.00	0.92	0.84	0.84	0.94	0.84
Van Duzen WAA	1.00	0.93	0.85	0.85	0.96	0.85
Lawrence Creek	1.00	0.95	0.88	0.88	0.98	0.99
Lower Yager Creek	1.00	0.95	0.89	0.89	0.98	1.00
Middle Yager Creek	1.00	0.97	0.89	0.89	1.00	1.00
North Yager Creek	1.00	0.93	0.85	0.85	0.98	1.00
Total Protection	**1.00**	**0.93**	**0.85**	**0.84**	**0.96**	**0.89**

[1/] Calculated using 170-foot no-harvest buffers for Class I streams and 85-foot buffers for Class II streams.

Source: Foster Wheeler Environmental Corporation



1/ Buffer widths are 170-foot, no-harvest for Class I streams, 85-foot, no-harvest buffer for Class II streams, and 50-foot no-harvest buffer for Class III streams.

2/ Default RMZs were used to calculate these acres.

Note: Riparian acres subject to harvest were based upon the RMZ buffer widths for each alternative. Any no-harvest marbled murrelet conservation areas that coincided with the RMZs were accounted for in Alternatives 2, 3, and 4. In addition, when calculating riparian acres, the GIS measured horizontal distance for Alternatives 1 and 3 and slope distance for Alternatives 2 and 4.

Figure 3.7-5. Acres of Riparian Harvest Prescriptions by Alternative for PALCO's Ownership and the Reserve

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aspect, location, and soil wetness; Harris, 1989).

In riparian areas consisting of even-aged second growth or streambank, implementing the initial WHR6 silvicultural prescriptions (Alternatives 2, 3, and 4) will expose the buffer edge to direct wind. This may cause a greater degree of tree fall compared to when the riparian areas were relatively protected from direct wind by the adjacent forest. Over time, the trees left standing will develop greater windfirmness, and later entries are likely to experience less blowdown. In Alternative 1, blowdown is likely to occur after the initial timber harvest. However, there will be no additional entries until the next rotation period. During that time, blowdown will diminish as the adjacent stand regrows, and the trees in the RMZ become more windfirm. In general, vulnerability to windthrow tends to return to normal a few years after logging (Moore, 1977; Steinblums, 1978; Andrus and Froelich, 1986). Because blowdown is generally greater at the windward edge of a buffer**,** alternatives with wider buffers will provide more protection to aquatic functions (e.g., Alternatives 1 and 3). At an HU scale, however, RMZ buffers will provide the functions discussed below.

Thresholds of Significance

Specific thresholds of significance are not presented for riparian lands. Rather, riparian lands were evaluated in terms of protection levels of individual riparian parameters. Protection is summarized as *no, low, moderate, high,* or *complete* protection. As each parameter (i.e., stream shade, LWD recruitment, leaf and needle litter, streambank stability, sediment control, and microclimate) is introduced, buffer width requirements that provide complete protection are identified before the alternatives are evaluated. Determination of protection levels is based on literature discussed in Section 3.7.4.1.

However, most of the studies available indicated levels of protection based solely on width of no-harvest riparian buffers. Because most of the alternatives include some level of activity within the RMZ (even if they meet the width prescribed as complete protection by the literature), professional judgment (guided by the literature) was also used to determine the reduced level of protection qualitatively, compared to complete protection. *Complete protection* meets all criteria determined in the scientific literature. *High protection* meets most components discussed in the scientific literature (e.g., width) but some aspects of the RMZ are slightly reduced from complete protection. *Moderate protection* is the next gradation below high protection. Moderate protection still meets a large proportion of the important components for the specific parameter considered. Despite the proportion of protection under the moderate level, there is a greater risk to the specific riparian function. *Low protection* substantially reduces the available function, though there are some components that will provide for protection of the resource. Additionally, *low protection* is used when there is a low level of certainty based on the available scientific literature that the protection provided is enough to maintain the specific function. *No protection* provides no protection of the specific riparian function, or negligible protection potential, with no certainty based on available scientific literature.

The determination of protection for each parameter is used in other sections to assist in the determination of thresholds of significance. Specifically, Section 3.8 (Fish and Aquatic Habitat) uses the level of riparian function to evaluate effects on fish habitat and on fish. Section 3.4 (Watersheds, Hydrology, and Floodplains) uses some of the riparian function determinations to evaluate effects on water quality. Section 3.10 (Wildlife) uses the level of riparian function to evaluate effects on riparian and aquatic-dependent wildlife species and their habitat.

RMZ protection was evaluated within the context of riparian management goals. When the goal is to maintain the aquatic system, fully protected riparian buffers of approximately one site-potential tree are considered adequate to maintain 90 to 100 percent of most key functions, including shading, LWD recruitment, leaf and needle litter inputs, bank stability, and sediment control. Many of these parameters receive high levels of protection at distances less than one site-potential tree. When the goal is to maintain riparian microclimatic conditions within the riparian zone essential for some wildlife species, then buffers may have to be substantially wider. For this analysis, the level of protection required to maintain the aquatic system was the main goal. However, for riparian microclimate, which is more likely to adversely affect semi-aquatic and terrestrial species, the most sensitive component (humidity) was used. Evaluations of the proposed alternatives on each riparian function are summarized in the following sections and Table 3.7-13. In addition, grazing was evaluated separately.

Headwaters Reserve

Alternative 1 (No Action/No Project)

Under Alternative 1, no Headwater Reserve would be established.

Alternatives 2 (Proposed Action/Proposed Project) and 2a (No Elk River Property)

Approximately 2,393 and 1,568 acres of riparian areas (based on Alternative 1 RMZ widths) would be placed in the Reserve in Alternatives 2 and 2a, respectively. These riparian areas are located primarily in the Elk and Salmon river HUs. Most of the Reserve (68 percent) comprises late seral and old-growth forest (See Appendix Table J-3). In Alternative 2a, approximately 824 riparian acres of Elk River Timber Company lands (all located in the Elk River HU and consisting primarily of late seral vegetation) would not become part of the Reserve. Under both alternatives, these riparian areas in the Headwater Reserve would ultimately be maintained or restored to levels equivalent to an old-growth system. Therefore, the Headwater Reserve would provide complete protection of all key functions, including shade, LWD recruitment, leaf and needle litter inputs, bank stability, sediment control, and microclimatic conditions.

Alternative 3 (Property-wide Selective Harvest)

Alternative 3 has the same number of RMZ acres (2,393 acres) in the Headwaters Reserve as would occur under Alternatives 2 and 2a. Similar to Alternative 2, young forest and forest open stands would decrease as trees mature. As a result, as in Alternative 2, these riparian areas in the Reserve would ultimately be maintained or restored to levels equivalent to an old-growth system and would provide complete protection of all key riparian functions over the extended long term (100-plus years) (see Appendix J).

Alternative 4 (63,000-acre No-harvest Reserve)

Approximately 18,801 acres of riparian areas (based on Alternative 1 RMZ widths) would be placed in the Reserve in Alternative 4. These riparian areas are located in the Eel Delta, Elk River, Salmon River, Van Duzen WAA, Lawrence Creek, Lower Yager, Middle Yager, and North Yager HUs. Most of the Reserve is equally divided into late (26 percent), mid (30 percent) and young (27 percent) successional forest. Old-growth forest would make up 9 percent of the Reserve and is primarily found in Elk, Salmon, Lawrence Creek, Lower Yager, and Middle Yager (Appendix Table J-3). Similar to Alternatives 2, 2a, and 3, these riparian areas in the Headwaters Reserve would ultimately be maintained or restored to

Table 3.7-13. Protection Levels Provided from RMZ to the Aquatic System (and for Microclimate Semi-aquatic System) by Alternative

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
WETLANDS AND RIPARIAN LANDS				
Riparian lands	Specific thresholds of significance are not presented for riparian lands. Rather, riparian lands were evaluated in terms of protection levels of individual riparian parameters. Protection is summarized as no protection, low, moderate, high or complete protection. The determination of protection for each parameter is used in other sections to assist in the determination of thresholds of significance. For each parameter and each alternative, a trend toward or away from a properly functioning aquatic system has also been determined.	See factors below	See factors below	See factors below
Stream shade	This evaluation is based on the level of shade protection that moderates stream temperature, considering width of, and silvicultural prescriptions within the RMZ. Determined trend toward or away from a properly functioning aquatic system.	Positive trend toward a properly functioning aquatic system **Class I streams**: Complete protection (for both the upper- and lower-range RMZ widths): 170- to 340-ft no-harvest buffer exceeds the buffer width required by literature for complete shade protection. **Class II streams**: Complete protection (for the upper range RMZ widths): 170-ft no-harvest buffer exceeds the buffer width required by literature; complete stream shade for protection.	Positive trend toward a properly functioning aquatic system **Class I streams**: High-to-complete protection: 170-ft RMZ (1st band 100-ft no-harvest, 2nd band 70-ft selective harvest [maintain 240-sq.-ft. phba[2] and meet dbh size class distribution[3] to maintain target of WHR6]; exceeds the width required by literature. 1st band no-harvest buffer meets the buffer width required by literature; 2nd band overstory canopy maintains 80 percent. Band 1 and 2 combined should exceed 80 percent overstory canopy. Overall shade potential maintained.	Positive trend toward a properly functioning aquatic system **Class I streams**: Complete protection: 340-foot no-harvest RMZ exceeds width required by literature; timber harvest can occur after watershed analysis is conducted. For analysis purposes, assumed 100-foot no-harvest portion of RMZ after watershed analysis is applied.

1 Watershed analysis, trend monitoring, and adaptive management do not apply to Alternative 4.
2 Post harvest basal area (phba).
3 See Appendix J for description of dbh size distribution.

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
		Class II streams: High protection (for lower-range RMZ widths): 85-ft no-harvest buffer, below the buffer width required by literature by 15 feet; most to all shade provided from expansive no-harvest buffers on small streams. **Class III streams**: not applicable. Streams tend to be intermittent or ephemeral and therefore do not influence water temperatures.	**Class II streams**: High protection: 100-ft RMZ inside Humboldt WAA and 130-ft RMZ outside Humboldt WAA (1st band 30-ft no-harvest, 2nd band selective harvest [maintain 240-sq.-ft. phba and meet dbh size class distribution[3] to maintain target of WHR6]). Meets the width required in most or all literature. 1st and 2nd band combined should maintain or exceed 80 percent overstory canopy. Overall shade potential maintained. **Class III streams** not applicable. **Class I, II and III streams**: Where applied, watershed analysis, trend monitoring, and adaptive management should increase protection by identifying sensitive areas and implementing site-specific prescriptions.	**Class II streams:** Complete protection: 170-foot no-harvest RMZ exceeds width required by literature; timber harvest can occur after watershed analysis is conducted. For analysis purposes, assumed 75-foot no-harvest portion of RMZ after watershed analysis is applied. **Class III streams**: not applicable **Class I, II and III streams**: Where applied, watershed analysis should increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.
LWD recruitment	This evaluation is based on level of protection provided to maintain complete LWD recruitment potential from the riparian zone using width of and silvicultural prescriptions within RMZ, and proportion of leave trees remaining in the RMZ. Determined trend toward or away from a properly functioning aquatic system.	Positive trend toward a properly functioning aquatic system **Class I streams**: Complete protection (for both the upper- and lower-range RMZ widths: 170- to 340-ft no-harvest buffer). Meets or exceeds the buffer width required by literature. Provides leave trees for 100 percent recruitment potential. **Class II streams**: Complete protection (for the upper range RMZ width): 170-ft no-harvest buffer. Meets the width recommended from literature. Provides sufficient leave trees for 100% recruitment potential.	Positive trend toward a properly functioning aquatic system **Class I streams**: High protection (see prescriptions under shade). Meets the width recommended from all literature. Provides approximately 97% of the leave trees for recruitment potential. **Class II streams**: Moderate-to-high protection: See prescriptions under shade. Meets the width recommended in some literature. Provides approximately 80 percent of the leave trees for recruitment potential outside of the Humboldt WAA and 77 percent inside of the Humboldt WAA. **Class III streams**: Low protection; no RMZ buffer; no source trees left; in ELZs or EEZ, no downed trees are removed[4]. Does not require large trees to function.	Positive trend toward a properly functioning aquatic system **Class I streams**: High-to-complete protection: 340-foot no-harvest RMZ exceeds width required by literature; timber harvest can occur after watershed analysis is conducted. For analysis purposes assumed 100-foot no-harvest portion of RMZ after watershed analysis is applied. Provides 100% recruitment potential before watershed analysis and 97% recruitment potential after watershed analysis.

4 25-ft ELZ for slopes <30 %; 50-ft ELZ for slopes >30%>50%; 100-ft EEZ for slopes > 50%.

Table 3.7-13. Protection Levels Provided from RMZ to the Aquatic System (and for Microclimate Semi-aquatic System) by Alternative

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
LWD recruitment	This evaluation is based on level of protection provided to maintain complete LWD recruitment potential from the riparian zone using width of and silvicultural prescriptions within RMZ, and proportion of leave trees remaining in the RMZ. Determined trend toward or away from a properly functioning aquatic system.	**Class II streams**: High protection (for the lower range RMZ width): 85-ft no-harvest buffer. Less than width recommended in the literature. Provides leave trees for 90% recruitment potential. **Class III streams**: High protection (for the upper range and lower range of RMZ width): 50- to 100-ft no-harvest buffer. Upper range meets the buffer requirements from some literature. Lower range does not meet the buffer width requirement but no-harvest band and smaller tree recruitment size required contribute to high protection. Provides 72 to 93% recruitment potential depending on RMZ width.	**Class I, II and III streams**: Where applied, watershed analysis, trend monitoring, and adaptive management should increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.	**Class II streams:** High-to-complete protection: 170-foot no-harvest RMZ exceeds width required by literature; timber harvest can occur after watershed analysis is conducted. For analysis purposes, assumed 75-foot no-harvest portion of RMZ after watershed analysis is applied. Provides leave trees for 92 percent recruitment potential. **Class III streams**: High protection: 100-foot no-harvest RMZ meets width required by some literature; timber harvest can occur after watershed analysis is conducted. For analysis purposes, assumed 25-foot no-harvest portion of RMZ after watershed analysis is applied. **Class I, II and III streams**: Where applied, watershed analysis should increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
Detritus production	This evaluation is based on level of protection provided to maintain detritus production using width of, and silvicultural prescriptions in, the RMZ. Determined trend toward or away from a properly functioning aquatic system.	Positive trend toward a properly functioning aquatic system **Class I streams**: Complete protection (for both the upper- and lower-range RMZ widths) 170- to 340-ft no-harvest RMZ exceeds the buffer width required by literature; complete leaf and needle litter recruitment potential provided. **Class II streams**: Complete protection (for the upper range RMZ widths): 170-ft no-harvest buffer, exceeds the buffer width required by literature; complete leaf and needle litter recruitment potential provided. **Class II streams**: High protection (for lower-range RMZ widths): 85-ft no-harvest buffer, below the buffer width required by some literature by 15 feet; most leaf and needle litter recruitment potential provided. **Class III streams**: High protection (for lower- and upper- range RMZ widths): 50- to 100-ft no-harvest RMZ; upper range meets the buffer width required by some literature, and lower range is below the buffer width required by literature.	Positive trend toward a properly functioning aquatic system **Class I streams**: High protection: 170-ft RMZ exceeds the buffer width required by literature. Maintains overall overstory to provide most if not all recruitment potential. **Class II streams**: High protection. Meets the buffer width required by all or most of the literature depending on whether inside or outside of Humboldt WAA (see shade for description of prescriptions). Selective harvest in all Class II prescriptions may reduce leaf litter production due to a reduction in trees per acre, but not expected to substantially alter leaf litter composition. **Class III streams**: No protection (for short to mid-term). No buffer provided. Therefore, until new trees grow back there would be a substantial reduction of leaf litter potential in localized areas (see Table 3.7-11). Watershed analysis does not target detritus production.	Positive trend toward a properly functioning aquatic system **Class I streams**: Complete protection: 340-foot no-harvest RMZ exceeds width required by literature; timber harvest can occur after watershed analysis. For analysis purposes, assumed 100-foot no-harvest portion of RMZ after watershed analysis is applied. No-harvest portion of RMZ meets the buffer width required by literature. **Class II streams:** High-to-complete protection: 170-foot no-harvest RMZ exceeds width required by literature; timber harvest can occur after watershed analysis. For analysis purposes, assumed 75-foot no-harvest portion of RMZ after watershed analysis is applied. High proportion is no-harvest. **Class III streams**: High protection: 100-foot no-harvest RMZ meets width required by some literature; timber harvest can occur after watershed analysis. For analysis purposes assumed 25-foot no-harvest portion of RMZ after watershed analysis is applied.

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
Bank stability	This evaluation is based on level of protection provided to maintain stream bank stability (using potential decrease of root density within 85 feet of the stream). Determined trend toward or away from a properly functioning aquatic system.	Positive trend toward a properly functioning aquatic system **Class I, II and III (upper range of RMZ width)**: Complete protection. No-harvest RMZs meet or exceed buffer width recommended in literature. Full protection of stream bank provided. **Class III streams (lower range of RMZ width)**: High protection; 50-foot no-harvest RMZ. Less than width recommended in literature; but streams small.	Positive trend toward a properly functioning aquatic system **Class I streams**: Complete protection. Exceeds the width based on literature and maintains 100 percent of root strength in band 1; limited reduction in band 2 that should not contribute to bank instability. **Class II streams**: Complete protection. Exceeds the width recommended in literature and maintains 100 percent of root strength in band 1; moderate reduction in band 2 (but in conjunction with band 1 will not contribute to bank instability). **Class III streams**: Low-to-moderate protection. Initial 5-11 years when bank stability most compromised. Does not provide buffer. Protection is increased once vegetation/trees grow back (small streams gain bank protection sooner with younger trees compared to larger streams with greater banks and more stream flow). Protection of bank provided from ELZ and EEZs and by leaving all downed wood within these zones. **Class I, II and III streams**: Where applied, watershed analysis, trend monitoring, and adaptive management should increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.	Positive trend toward a properly functioning aquatic system **Class I, II and II streams**: Complete protection. No-harvest RMZs meet or exceed widths recommended in literature. **Class I, II and III streams:** Where applied, watershed analysis should increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
Microclimate	This evaluation is based on protection of microclimatic conditions near stream using width of, and silvicultural prescriptions in, the riparian zone. There is less protection if microclimatic conditions are to be maintained for the entire riparian area (specifically for riparian-dependent species). Buffers at least 200 ft wide on each side of the stream are needed to maintain an unaltered microclimatic gradient near streams. However, may require greater buffer widths for certain variables up to 575 ft, especially if microclimatic conditions are to be maintained for the entire riparian area, particularly on streams greater than 13 ft (Brosofske et al. 1997).	Overall, moderate protection for riparian microclimate but improvement compared to existing condition for the terrestrial environment. **Class I streams**: Moderate-to-high protection. Upper range of widths meets the buffer required for smaller streams; may have reduced protection on larger streams. **Class II streams:** Moderate protection. Below the width recommended in literature, but substantial no-harvest portions of RMZ. **Class III streams**: Low-to-moderate protection; buffer width less than literature recommends, but provides some no-harvest protection.	Overall, low-to-moderate protection for riparian microclimate (maybe reduced after watershed analysis) but improvement compared to existing condition for the terrestrial environment. **Class I streams**: Moderate protection. Buffer width less than literature recommends, combined with silvicultural prescriptions that may further reduce microclimatic conditions. Limited understanding of riparian microclimate response to selective harvest. **Class II streams**: Low protection: Buffer width less than literature recommends, combined with silvicultural prescriptions that likely further reduce microclimatic conditions surrounding the stream. **Class III streams**: No protection. No RMZ maintained. Watershed analysis does not target microclimate.	Moderate-to-high overall protection for riparian microclimate before watershed analysis. May be reduced after watershed analysis. Is an improvement compared to existing condition for the terrestrial environment. **Class I streams:** Complete-to-high protection before watershed analysis. Meets RMZ width recommended in some literature. After watershed analysis, moderate-to-high protection. Expansive no-harvest portion of RMZs with adjacent selective harvest. **Class II streams**: Moderate to high before watershed analysis. Expansive no-harvest RMZs. After watershed analysis, moderate protection. Large proportion no-harvest with adjacent selective harvest. **Class III streams**: Low-to-moderate protection before watershed analysis: Buffer width less than literature recommends. After watershed analysis: Low protection; limited no-harvest portion with reduced RMZ compared to recommendations in literature.

Table 3.7-13. Protection Levels Provided from RMZ to the Aquatic System (and for Microclimate Semi-aquatic System) by Alternative

FACTOR/ SUBFACTORS	THRESHOLD(S) OF SIGNIFICANCE	ALTERNATIVE 1 NO PROJECT	ALTERNATIVE 2 PROPOSED HCP and ALTERNATIVE 4 63,000 ACRE RESERVE[1]	ALTERNATIVE 3 PROPERTY-WIDE SELECTIVE HARVEST
Sediment control	This evaluation is based on level of protection of sediment filtrating capacity in the riparian zone from hillslope erosion using width of and silvicultural prescriptions in the RMZ, as well as timber harvest method, whether removal of downed woody material allowed, and other Best Management Practices applied to the riparian zone. Determined trend toward or away from a properly functioning aquatic system.	Positive trend toward a properly functioning aquatic system. **Class I streams:** Complete-to-high protection. Upper- and lower-range RMZ widths meet or exceed buffer width recommended in literature; expansive no-harvest RMZs. **Class II streams:** (Upper-range RMZ width): High protection. Meets width recommended in literature, expansive no-harvest RMZs. **Class II streams:** (Lower-range RMZ width)**:** Moderate-to-high protection; less than recommended in literature; expansive no-harvest RMZ. **Class III streams (**Upper range RMZ width)**:** High protection. Meets buffer width based on some literature; expansive no-harvest RMZ. **Class III streams (**Lower range RMZ width)**:** Moderate-to-high protection; Does not meet buffer width based on literature; no-harvest RMZ.	Positive trend toward a properly functioning aquatic system. **Class I streams**: High protection: Exceeds width based on most literature. 100-ft no-harvest band, selective harvest in second band. No fire, EEZ, maintain all downed trees, treat all 100-square-foot or greater exposed mineral soil in RMZ and treat all sites less than 100 square feet on slopes greater than 30 percent if site can deliver fine sediment to the watercourse. On slopes greater than 50 percent, increase outer band to slope break. Low-impact logging methods in selective-harvest bands maximize sediment filtering capacity in managed zones. **Class II streams**: High protection. Meets the width requirements based on literature. 30-foot no-harvest band, selective harvest in second band, but minimized by EEZ, maintaining all downed wood, treat exposed mineral soil in RMZ the same as Class I streams, increase outer band to slope break. **Class III streams**: Low-to-moderate protection (recovery takes approximately 5 years). Does not meet width requirements based on literature but does provide for some protection of sediment-filtering capability through ELZ in 0 to 50% slopes and EEZ in slopes greater then 50% by maintaining all downed trees in ELZ and EEZ, and by providing same treatments to exposed mineral soil in EEZ and ELZ as Class I streams in RMZs. **Class I, II and III streams:** Where applied, watershed analysis, trend monitoring, and adaptive management should increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.	Positive trend toward a properly functioning aquatic system. **Class I, II streams**: Complete protection. Expansive no-harvest RMZs prior to watershed analysis. Meets or exceeds recommended buffer widths found in the literature. **Class III streams**: High protection. Expansive no-harvest RMZ prior to watershed analysis. Meets recommended buffer widths in some literature. **Class I, II and III streams**: Where applied, watershed analysis should maintain or increase protection on all streams by identifying sensitive areas and implementing site-specific prescriptions.

Source: Foster Wheeler Environmental Corporation

levels equivalent to an old-growth system, and, therefore, would provide complete protection of all key functions. In Alternative 4, however, the Headwaters Reserve would cover a much larger land base, providing more riparian areas complete protection over the long term.

Grazing

Studies have shown that livestock grazing within riparian areas eliminates or reduces streamside vegetation, destabilizes streambanks, causes channel sedimentation and aggradation, widens channels, increases stream temperature extremes, lowers the water table, reduces bank undercut, and reduces pool frequency and depth (Armour et al. 1991; Chaney et al. 1991; Kauffman and Drueger 1984; Dovalchik and Elmore, 1992; Meehan 1991; Platts, 1991).

Grazing (Alternatives 1 to 4)

Under Alternatives 1 and 3, grazing pressure would remain consistent with past use. Because little information exists on current grazing parcels, it is difficult to determine the effects to riparian areas under the alternatives. However, overall, it is anticipated that less than significant impacts are anticipated to occur to riparian resources due to the small acreage of leased lands, their patchy distribution, and the physical features that limit cattle access to riparian areas. Additionally, cattle stocking levels are relatively low, and many of the parcels contain fences or physical features that limit cattle access to riparian areas. Moreover, ranches usually try to keep cattle away from creeks due to possible serious injuries or deaths if cattle fall down steep gradient channels. Ranchers limit cattle access to streams by using fences, and by locating salt, and developing watering facilities up in pastures to lure the cattle away from riparian areas. Although these practices, along with current fencing and topography, limit cattle access to riparian areas, localized significant impacts to water quality and the aquatic ecosystem may occur in portions of the leased lands (see Section 3.6).

Under the proposed HCP (Alternatives 2 and 4), grazing pressure may be increased from its current level of 600 head to 1,000 head (cow-calf pairs) at any one time during the term of the ITPs (PALCO HCP, 1998). Due to the increase in grazing pressure, localized negative impacts (overall, less than significant for CEQA purposes), including reduction in streamside vegetation, compaction, and sedimentation, may occur on portions of PALCO's lands, especially in areas that currently have higher cattle allotments (see Section 3.6). Areas that may be most impacted include the South Rainbow Ranch (1,800 acres), Chase Ranch (1,250), and Corbett Ranch (23 acres). All of these sites contain creeks, and two contain fish-bearing streams (Corbett Ranch and South Rainbow Ranch). Additionally, some of these areas are characterized by steep terrain. Because of cattle's avoidance of steep terrain and their tendency to congregate in riparian ecosystems, riparian resources in these areas may be somewhat degraded.

Since livestock are widely dispersed, grazing pressure is relatively low, and physical features limit cattle's access to watercourses, less than significant impacts overall would occur to riparian resources under these alternatives.

PALCO does not propose new mitigation measures under its HCP due to the relatively low level of associated impacts. However, grazing in specific watersheds would be evaluated as part of the watershed analysis process. Watershed analysis would specifically address grazing issues where applicable.

Stream Shade

Based on the review in Section 3.7.4.1, it was concluded that buffer widths of approximately 0.75 site-potential tree height, or 120 feet, is needed to provide full protection of stream shading. However, most of the literature indicates that adequate shade usually can be provided by leaving a strip of trees next to the stream in a width of about 100 feet, particularly if canopy cover of at least 85 percent is maintained (which is comparable to shade found in an old-growth stand). Current FPR buffer widths are sufficient to provide full protection of these functions for Class I streams with sideslopes exceeding 50 percent. Trees for shade can consist of unmerchantable hardwoods and conifers (Murphy, 1995). However, FPR's requirement of a 50 percent canopy retention on Class I and II streams and 75 percent removal of the overstory conifers appears to be too low to maintain adequate stream shade to provide full protection (Murphy, 1995). In general, the studies reviewed by Belt et al. (1992) indicated that removal of forest canopy within the buffer strip reduces its effectiveness by reducing shade. Coho consideration guidelines (CDF, 1997b) increase protection of shade canopy in areas where water temperatures exceed preferred temperatures. Class III streams do not have harvest limitations and, therefore, do not provide any protection for shade. Most Class III streams, however, do not flow in the summer and should therefore be of minimal concern relative to temperature.

ALTERNATIVE 1 (NO ACTION/NO PROJECT)

The state and federal assumptions for assessing environmental impacts to aquatic resources under the No Action/No Project alternative differ due to the analytic approach required by CEQA and NEPA. CEQA implementing regulations require that an EIR discuss "the existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved (14 CCR 15126[d][4])." CEQA requires neither a projection into the long-term future that could be deemed to be speculative, nor a quantitative analysis of the No Action/No Project alternative for comparison with the other alternatives. Accordingly, the state version of the No Action/No Project alternative analyzed here contemplates only the short term and is based on individual THPs that would be evaluated case by case. The CDF version of No Action/No Project does not attempt to forecast how PALCO's entire property would look in 50 years (the length of the proposed ITP). Since how many THPs there would be, where they would lie geographically, and how they would differ in detail are unknown, no quantitative analysis of THPs is presented (see Section 2.5).

The likely No Action/No Project alternative would consist of PALCO operating in a manner similar to current THP practices and subject to existing CDF regulatory authority. In reviewing individual THPs, CDF is required to comply with the FPA, FPRs, and CEQA through its certified functional equivalent program (see Section 1.6). The specific criteria for evaluating THPs contained in the FPRs are combined with the case-by-case evaluation of each THP for significant effects on the environment, followed by consideration of alternatives and mitigation measures to substantially lessen those effects. Under CEQA and the FPRs, CDF must not approve a project including a THP as proposed if it would cause a significant effect on the environment, and there is a feasible alternative or feasible mitigation measure available to avoid or mitigate the effect. An adverse effect on a listed threatened or endangered species would be a significant effect under CEQA.

In addition, the present FPRs provide that the Director of CDF shall disapprove a timber harvesting plan as not conforming to the rules if, among other things, the plan would result in either a taking or a finding of jeopardy of wildlife species listed as rare, threatened, or endangered by the Fish and Game Commission or a federal fish or wildlife agency, or would cause significant, long-term damage to listed species. To make a determination as to the effect of a THP on listed fish or wildlife species, CDF routinely consults with state agencies and notifies federal fish and wildlife agencies. These processes and independent internal review by CDF biologists can result in a THP containing additional site-specific mitigation measures similar to those described in the Proposed Action/Proposed Project alternative. CDF believes that its existing process, using the FPRs and the CEQA THP-by-THP review and mitigation, is sufficient to avoid take of listed species.

The mitigation by which an individual THP is determined to comply with FPRs, the FESA and CESA, and other federal and state laws is determined first by compliance with specific standards in the FPRs and then by development of site-specific mitigation measures in response to significant effects identified in the CEQA functional equivalent environmental analysis of the individual THP. A wide variety of mitigation measures tailored to local conditions is applied with the purpose of avoiding significant environmental effects and take of listed species. These include, but are not limited to, consideration of slope stability, erosion hazard, road and skid trail location, WLPZ width, BMPs on hillslopes and within WLPZs, and wildlife and fish habitat. Consequently, the most significant effects of individual THPs are expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative. In some cases, CDF may determine that it is not feasible to mitigate a significant effect of a THP to a level of less than significant. In such a situation, CDF would have to determine whether specific provisions of the FPRs such as not allowing take of a listed threatened or endangered species would prohibit CDF from approving the THP. If approval is not specifically prohibited, CDF would have to weigh a variety of potentially competing public policies in deciding whether to approve the THP. A THP with a significant remaining effect could be approved with a statement of overriding considerations, but such an approval would be rare.

As noted in Section 2.5, the degree of analysis devoted to each alternative in the EIS under NEPA will be substantially similar to that devoted to the Proposed Action/Proposed Project alternative. The federal agencies recognize that a wide variety of potential strategies could be applied that could represent a No Action/No Project scenario and that they would involve consideration of the same mitigation measures as described above. For the purposes of analysis under NEPA, however, these additional mitigation measures are represented as RMZs, rather than management options developed for site-specific conditions. Consequently, the analysis of the No Action/No Project alternative considers the implementation of wide, no-harvest RMZs as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long term. Ranges of RMZ width are considered qualitatively because it is expected that adequate buffer widths could vary as a result of varying conditions on PALCO lands.

Under Alternative 1, no acquisition or transfer of lands would occur. For the purpose of modeling within this alternative, no-harvest RMZs for Class I streams range between 170 and 340 feet, Class II streams range between 85 and 170 feet, and Class III streams range between 50 and 100 feet. These RMZs are measured horizontally from the edge of the channel migration zone or the vegetation transition line. This measurement of the RMZs on each side of Class I (170 to 340 feet) and the upper end of the range (170 feet) along Class II streams would consistently be wider than the widths recommended in the literature for stream shade (see Section 3.7.4.1 and Figure 3.7-2a).

For Class II streams, the lower end of the range (85 feet) does not meet the buffer width requirement recommended in the literature for stream shade. However, the 85-foot RMZ is no-harvest and close to the requirement established in the literature; and Class II streams tend to be smaller than Class I streams (averaging 5 feet); thus, the risk is reduced. To substantiate this claim, smaller streams could be partially or fully shaded with overhanging shrubs and young trees which are not large enough to shade larger streams. Therefore, the additional shade provided by meeting literature standards would likely be negligible or nondetectable when provided to these small streams.

The RMZs on Class III streams would be equivalent to buffer widths recommended in literature for the upper end of the range (100 feet). The lower end of the range (50 feet) does not meet the shade requirement defined in the literature. However, along Class III streams, which do not flow in the summer, this RMZ width has minimal effects on summer stream temperature.

Approximately 31,060 to 58,811 acres of no-harvest RMZs would be protected under Alternative 1 on PALCO ownership (Figure 3.7-5 and Appendix Table J-2) depending on the RMZs established. Additional riparian acres are also found in old-growth and residual old-growth stands that are occupied by marble murrelets (see Section 3.10.). These stands would not be harvested under this alternative and would be provided complete protection of shade. Currently, most of the riparian vegetation is at least in mid-seral stage (20 to 50 years) (Tables 3.7-8 and 3.7-11). Therefore, a large proportion of the existing buffers is currently effective in providing stream shade. As a result, with the protection provided by this alternative, adequate shade (ACD densities) comparable to old-growth stands (i.e., 80 to 90 percent) would be provided throughout PALCO's ownership within the next 20 to 40 years (see Table 3.7-11) as newly harvested areas mature (see Section 3.4), unless the vegetation is naturally sparse. This prediction is supported by the Forest Resource Inventory, Growth, and Harvest Tracking System (FREIGHTS) model (see Sections 3.9 and 3.10 for description) which characterizes all of the RMZ acres (not including naturally sparse vegetation types) falling into at least the mid-successional category within the long term (50 years) (Appendix Table J-5). This alternative also provides a safety margin to offset risks to habitat from unknown or uncontrollable factors such as blowdown and mass wasting events affecting Class I and most Class II streams. Therefore, this alternative would provide complete stream shade protection for all Class I and Class II streams with the higher RMZ widths. Class II streams with the lower-range RMZ widths would be provided high protection (see Table 3.7-13).

ALTERNATIVES 2 (PROPOSED ACTION/PROPOSED PROJECT) AND 2A (NO ELK RIVER PROPERTY)

As discussed in Section 2.5, aquatic mitigation measures are applied two separate ways that directly affect the riparian area. These include property-wide prescriptions and prescriptions generated from watershed analysis. In this section, the property-wide prescriptions that apply to the riparian zone are analyzed in terms of protection levels of shade based on (1) the riparian buffer width, and (2) the allowable level of activity within that buffer for each stream class (I, II, and III). Watershed analysis is based on site-specific information that evaluates the aquatic and riparian system in terms of habitat condition before determining site-specific prescriptions. Therefore, it is not possible to analyze potential prescriptions, but the intent of watershed analysis will be discussed.

RMZ Buffer Widths

In the HCP planning area, the Class I streams would be given a minimum RMZ buffer width of 170 feet. For Class II streams, timber harvest takes into account several aspects of the riparian management zone. The first consideration is whether the area is within the Humboldt WAA. Mitigation measures also vary according to whether the stream channel sideslope is less than or greater than 50 percent. In the Humboldt WAA, a minimum 100-foot RMZ would be established along all Class II streams. Outside the Humboldt WAA, all Class II streams would have at least a 130-foot RMZ buffer width.

RMZ buffer widths are measured using slope distance from the edge of the CMZ (or vegetation transition line). These RMZ measurements on each side of Class I and Class II streams meet or exceed the widths recommended in most of the literature for protection of stream shade (see Figure 3.7-2a). On Class III streams, harvest would be allowed to the streambank and, therefore, does not provide any specific protection to stream shade. Class III streams, however, do not flow in the summer and should have minimal effect on temperature.

Allowable Level of Activity Within the RMZ

The first band (100 feet from the CMZ or vegetation transition line) along Class I streams would be a no-harvest zone. This no-harvest band meets the width recommended in most of the literature for protection of stream shade. The second band (100 to 170 feet from the CMZ) would allow selective timber harvest (not to be reduced below 240 square feet basal area), but would be required to meet PALCO's Late Seral, Selection Target WHR6 silvicultural prescription (see Appendix J, Attachment J-1 for required dbh size distribution). The 240-square-foot basal area prescription canopy reduction should maintain a canopy closure of 80 percent (Personal communication, M. Jameson, CDF, May 26, 1998). FWS completed a modeling exercise that supports this estimate (Peters 1998). This level of canopy closure is comparable to an old-growth stand (Brazier and Brown, 1973). This alternative's RMZ prescriptions provide more protection of shade along Class I streams than do the FPRs, but are less protective than Alternative 1. However, the difference in shade protection along Class I streams between Alternative 2 and Alternative 1 is negligible, because the first 100 feet of Class I streams under Alternative 2 is no-harvest (maintaining the maximum overstory canopy available). Therefore, Class I streams should be provided close to or complete protection of shade within the RMZ under this alternative.

For Class II streams in and out of the Humboldt WAA, the first band (30 feet from the CMZ) would be a no-harvest zone. Outside of the no-harvest band, all Class II stream RMZs are required to meet the same selective harvest prescription as the second band along Class I streams, described above. No data in literature conclusively demonstrates that a 30-foot, no-harvest zone next to the stream combined with a 70- to 100-foot, 240-square-foot basal area prescription guarantees 80 percent or greater overstory canopy cover. However, because experience indicates that a 240-square-foot basal area prescription maintains an 80 percent canopy closure (Personal communication, M. Jameson, CDF, May 26, 1998), and a modeling exercise also support this estimate (Peters 1998) the combined no-harvest, selective harvest band would result in at least an 80 percent overstory canopy cover and likely a greater canopy cover.

Overall, the no-cut portions of RMZs would provide a higher level of protection and increase shade in areas where applied. Although a Class II stream no-harvest band is less expansive than the band for

Class I streams, it is still considered high protection for shade. The risk of reduced RMZ effectiveness to provide shade along Class II streams is lowered because Class II streams tend to be smaller then Class I streams (averaging 5 feet of active channel). As a result, smaller streams could be partially or fully shaded with overhanging shrubs and young trees that are not large enough to shade larger streams. Also, as discussed above, a 240-square-foot basal area canopy cover along these smaller streams (with the tree site distributions met) would likely maintain at least an 80 percent overstory canopy, which is similar to old-growth forests.

Additional riparian acres are found in stands of MMCAs that would not be harvested under this alternative (See Section 3.10). As a result, the additional acres are included under category A - no harvest, found in Figure 3.7-5 and Appendix Table J-3. The MMCAs would ensure complete protection of shade through the preservation of these stands. The MMCAs provide protection in the Elk River, Van Duzen River, Lawrence Creek, and Lower Yager Creek HUs.

Alternative 2 would provide more improvement of shade on PALCO land with the implementation of the HCP than that provided from FPRs (prior to coho considerations) along Class I and II streams (Figures 3.7-3a and b). In the long term (50 years), the FREIGHTS model predicts that most Class I and II RMZs that support conifers will be mainly composed of mid-successional and late seral stages, with most young forest and forest open seral stages no longer present (Appendix Table J-5). All late seral stage vegetation and most mid-seral stage vegetation are considered to be functioning adequately to provide shade to Class I and II streams (See Table 3.7-11). As a result, most of PALCO's riparian areas should meet the shade requirement within the life of the HCP.

Overall, Alternative 2 would be expected to provide the stream shade required to maintain or improve Class I and Class II stream water temperatures along all of PALCO's ownership (see Table 3.7-13). Class I streams also provide a safety margin similar to Alternative 1 (but not as expansive) that would increase protection of shade if the RMZs were reduced by uncontrollable factors such as blowdown. Class II streams meet the requirements needed to maintain or improve shade requirements described in the literature. Where implemented, site-specific evaluations and prescriptions developed from watershed analysis and trend monitoring should provide sufficient information to protect shade along all streams, even if RMZs are reduced. For both Class I and Class II streams, the no-harvest portion of the RMZs may be modified by watershed analysis prescriptions to no more than 170 feet (horizontal measurement) and no less than 30 feet (slope measurement on each side of the watercourse). Along Class II streams, the no-cut buffers may be modified by watershed analysis and may be reduced to a minimum of 10 feet if FWS and NMFS determine it will benefit aquatic habitat or species.

Alternative 3 (Property-wide Selective Harvest)

Alternative 3 would provide full protection of stream shade through the designated 340-foot no-harvest RMZ buffers on Class I streams, 170-foot no-harvest buffers on Class II streams, and 100-foot no-harvest buffers on Class III streams. These buffers are measured horizontally from the CMZ. Timber harvest could occur after a watershed analysis was completed and site-specific harvest prescriptions were developed on a site-specific riparian scale that identifies stream conditions. For the purpose of modeling within this alternative, no-harvest buffers for Class I streams are 100 feet, for Class II streams are 75 feet, and for Class III streams are

25 feet. Within the harvestable portion of the stream buffers, the same selective harvest prescription as the second band of Class I and Class II streams in Alternative 2 (240-square-foot basal area prescription) would be allowed. As a result, complete protection of shade would be maintained for Class I streams if this harvest strategy was implemented. The potential reduced size of the no-harvest RMZs along the Class II and III streams should still afford sufficient protection to provide for all shade requirements because of the combination of a no-cut band and the restrictive harvest, as well as the site-specific evaluation through watershed analysis.

The old-growth and residual stands plus their 600-foot buffer are all represented in Figure 3.7-5 and Appendix Table J-3 under category A—no harvest. Except for Alternative 1 (the upper end of the range of the RMZ widths), this alternative has the most no-cut RMZs among the alternatives. Also, Alternative 3, similar to Alternatives 1 and 2, has a reduction of young forest and forest open stands and an increase in mid and late seral stands as the trees within RMZs mature (see Appendix Table J-5).

Alternative 3 would ultimately provide the second-most RMZ protection overall after Alternative 1 with the upper end of the range RMZ widths (see Figures 3.7-3a, b, c). It would maintain adequate shade comparable to old growth throughout PALCO's ownership and would provide for a safety margin that is almost equivalent to Alternative 1 for uncontrollable factors such as blowdown. As a result, this alternative would provide the complete shade needed for the aquatic environment (see Section 3.8).

ALTERNATIVE 4 (63,000- ACRE NO-HARVEST RESERVE)

Alternative 4 RMZs for Class I, II, and III streams in the PALCO HCP planning area would follow the same buffer requirements and harvest restrictions as Alternative 2. As a result, the same effects would be anticipated; the RMZs would provide complete protection of stream shade on Class I streams and high protection of stream shade on all Class II streams (see Table 3.7-13). Class III streams are intermittent or ephemeral and, therefore, do not require stream shade protection. Also, the 63,000-acre Reserve would provide complete protection of stream shade for all stream classes. The HUs that gain the most protection from the Reserve include Elk River, Lower Yager, Middle Yager, North Yager, Lawrence, and Salmon Creek.

Similar to Alternatives 1, 2, and 3, the FREIGHTS model predicts the reestablishment of suitable canopy cover over the midterm to provide adequate stream shade over most streams (Appendix Table J-5). Most of the open forest and young forest successional stages are maturing, and no new harvest is taking place. This improving trend is maintained over the long term.

In summary, Alternative 4 would be expected to provide stream shade required to maintain or improve Class I and II streamwater temperatures in all of the planning area. The RMZs located within the Reserve would have high to complete protection of stream shade (see Table 3.7-13).

LWD Recruitment

The approximate level of protection for LWD recruitment can be estimated based on buffer width and prescriptions for leave trees within the buffer. Buffer width determines the area from which potential source trees can contribute LWD, and prescriptions determine how much of this potential material remains after timber harvest (Murphy, 1995). Full recruitment of LWD by toppling, windthrow, or stream undercutting will generally occur if no-harvest riparian buffers of one site-potential tree height are retained (see

Figure 3.7-2b). An exception to this may occur in second-growth stands where hardwoods have excluded regeneration of coniferous trees leading to the depletion of large size classes of debris (Spence et al., 1996).

Recent practices under FPR buffers (before coho considerations) do not maintain complete LWD recruitment potential to the stream channel because the buffers are less than one site-potential tree height, and removal of conifers is allowed within the RMZ (i.e., WLPZ) (see Figures 3.7-3a, b, and c and Table 3.7-10). Murphy (1995) analyzed the effectiveness of California's riparian buffers based on buffer widths and leave tree requirements along fish-bearing streams and concluded that the percentage of LWD source trees remaining in the riparian zone after harvest was approximately 23 percent of full LWD recruitment potential, when only minimum FPR standards are followed. These values indicate substantial reduction in long-term ability of the RMZ to provide wood to the stream channel under FPRs (without including coho considerations). There is no provision for recruitment of wood into Class III streams. In Class III streams, however, LWD size necessary to provide function is much smaller. However, the guidelines of coho considerations (CDF, 1997b) increase protection of LWD recruitment in areas where instream LWD is deficient.

Alternative 1 (No Action/No Project)

As noted in Section 2.5 and introduced under the sub-section above regarding shade, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA, the No Action alternative is not projected into the long-term future. In the short term, conformance with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP and site-specific basis. A wide variety of mitigation measures tailored to local conditions is applied with the purpose of avoiding significant environmental effects and take of listed species. Consequently, most significant environmental effects of individual THPs are expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5 and under the sub-section above regarding shade, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs, as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long term. Ranges of RMZs are considered qualitatively because it is expected that adequate buffer widths could vary as a result of diverse conditions on PALCO lands.

Under Alternative 1, no acquisition or transfer of lands would occur. For the purpose of modeling within this alternative, no-harvest RMZs for Class I streams range between 170 and 340 feet, Class II streams range between 85 and 170 feet, and Class III streams range between 50 and 100 feet. These RMZs are measured horizontally from the edge of the channel migration zone or the vegetation transition line.

RMZs provided by Alternative 1 for Class I streams (which equal one to two site-potential tree lengths when considering both ends of the range) meet or exceed the widths recommended in the literature for full LWD recruitment (which is one site-potential tree length). RMZs for Class II streams are equivalent to what is recommended in literature when considering the upper end of the range and, therefore, would provide complete protection of future LWD loading. The lower end of the range for RMZ widths provided to protect Class II streams would recruit approximately 90 percent of the LWD available from riparian sources (McDade et al., 1990). Class III streams would recruit approximately 72 to 93 percent of the LWD available from riparian sources for the lower and upper ranges of the RMZ widths, respectively (McDade et al., 1990). For both Class II streams with an RMZ width of 85 feet and Class III streams with a width ranging between 50 and 100 feet, a large proportion but not all of the recruitment potential would be retained. The size of the LWD needed for Class III streams to function, and to a lesser extent for Class II streams, is substantially less than Class I streams. The RMZs provided would ensure that LWD recruitment potential would be maintained for Class I and Class II streams (with the 170-foot RMZ widths) and most of the protection for Class II (with the 85-foot RMZ width) and Class III streams over the long term. On the upper end of the range of RMZ widths for Class I streams, this alternative also provides a safety margin to offset risks of the RMZs blowing down all at once and, therefore, ensures LWD input rates over the long term.

In Appendix Table J-2 and Appendix Figures J-1a and b, a 60-year-old stand described in Appendix K of PALCO's SYP (1997) was used to compare expected densities of trees left in a mature riparian stand among the alternatives. This modeled stand is used for comparative purposes. The site class and timber type found within a site-specific RMZ will determine whether more or less trees of different size class distributions occur in an individual 60-year-old stand. For the purpose of these comparisons, dbh classes 22 to 30, 30 to 40, and 40+ inches were considered capable of functioning as key pieces if recruited into a Class I stream. These comparisons are based on an average stream width of 16 feet (Bisson et al., 1987). For Class II streams, dbh classes considered capable of functioning as key pieces begin at 14 inches. These comparisons were based on an average stream width of 5 feet. McDade et al. (1990) assessed percent contribution of LWD from selected distance categories (Figure 3.7-2b) and this assessment was used to determine cumulative percent of LWD recruitment (using their mature conifer curve). Based on this analysis, if no harvest occurred, there would be 100 percent of LWD source trees remaining in the RMZ along Class I and most Class II streams.

The EBAI for LWD, which takes into consideration both buffer width and the management activities that occur within the buffer, shows that the upper range of RMZ buffer widths in this alternative provides the highest level of protection overall for future recruitment of LWD (see Table 3.7-12 and Figure 3.7-4). The lower range under this alternative provides close to the same level of protection as Alternative 3. Both Alternative 1 lower range RMZ width and Alternative 3 RMZs have a large proportion of no-harvest trees (see Alternative 3). Alternative 1, Class II streams (with lower range RMZ widths) also provide complete protection where streams flow through occupied marbled murrelet stands. Not all marbled murrelet stands are currently identified and, therefore, included in the EBAI analysis. Alternative 3 also has additional protection provided to streams that flow through no-harvest old-growth and residual stands, as well as additional buffers that surround stands (see Alternative 3 for more complete discussion on protection measures for LWD.)

Under current conditions, 19 percent (see Table 3.7-8) of the riparian acres on PALCO ownership is dominated by forest openings, young forest, and hardwoods; thus, the quality of LWD input would be less than optimum until these areas grow to a conifer-dominated state that has trees of a sufficient size to provide LWD recruitment (see Table 3.7-11). Under this alternative, young successional Douglas-fir and redwood stands and hardwood-dominated stands would be expected to take longer to recover than stands that have some level of human intervention to accelerate tree growth (e.g., removal of hardwoods and thinning of conifers to minimize competition). The rate of growth for Douglas-fir and redwood trees is greatly reduced when trees have to compete with each other and/or with hardwood trees.

Under this alternative, all old-growth stands found in the RMZ would be preserved, maintaining optimum LWD recruitment potential. Forty-five percent of the riparian acres on PALCO ownership is dominated by mid-seral forest (20 to 50 years old) (see Table 3.7-8). Currently, only some of the mid-seral trees are large enough to function as LWD depending on the size of the stream (Bilby and Ward, 1990). Along smaller streams a larger proportion of the available trees in a mid-seral stand would function, if recruited. Mid-successional redwood trees, because of their faster growth rate, are expected to grow to levels sufficient to provide for long-term recruitment of LWD for most streams during the lifetime of the HCP. Douglas-fir stands would not be expected to recover as quickly because of their slower growth rate. The FREIGHTS model predicts that most RMZs that support conifers would be predominantly mid-successional, followed by late seral, in the long term (within the lifetime of the HCP) (Appendix Table J-4).).

Redwood and Douglas-fir late seral stands would not likely have enough large trees to provide for stable LWD in larger streams and rivers. These water bodies may require recruitable trees as great as 40 inches dbh (at a minimum) to be considered key pieces for long-term contributions to aquatic habitat (see Section 3.4); otherwise, they are at risk of floating away in large flood events. To provide a context for comparative purposes, in the 60-year-old stand described in Appendix J (see Appendix Figure J-1a), approximately three trees, 40 inches in diameter, would be found per 100 feet of the stream within 100 feet from the CMZ. In one example of an old-growth stand, approximately 10 trees, 40 inches in diameter, would be found per 100 feet of the stream within 100 feet of the CMZ (based on a 400-square-foot basal area, 45 trees per acre (TPA), with an average diameter tree of 40 inches) (Dillworth, 1975). The lower the number of recruitable large trees the lower the chances for large tree recruitment. In addition, the trees found within late seral stands (where trees have not yet reached senescence) would not be expected to be recruited from tree mortality, but would be recruited as a result of streambank undercutting, blowdown, or incidental recruitment from mass wasting events. Within an old-growth stand, however, there is the added component of tree mortality, which would provide an additional recruitment source.

Overall, Alternative 1 would be expected to have a positive effect on LWD recruitment potential over the long term (see Table 3.7-13). LWD recruitment potential would be maintained where sufficient levels are already available. Within PALCO's ownership, however, there are some areas where additional time, beyond the life-span of the HCP, would be required before enough recruitable large trees would be available to provide enough LWD (see Table 3.7-11).

Alternatives 2 (Proposed Action/ Proposed Project) and 2a (No Elk River Property)

In the discussion of shade, there are two separate ways aquatic mitigation measures directly affect the riparian area. These include property-wide prescriptions and prescriptions generated from watershed analysis. The prescriptions that apply to the riparian zone are analyzed in terms of protection levels for LWD. In the following section, this analysis is based on (1) the RMZ width and; (2) the allowable level of activity within that RMZ for Class I, II, and III streams.

RMZ Buffer Widths

Alternative 2 specifies an RMZ buffer width of 170 feet on Class I streams. In addition, on slopes greater than 50 percent, the RMZ will be extended to slope break. Class I RMZs meet the width recommended in the literature for LWD recruitment (and exceed it in some circumstances). In addition, because these buffers are measured from the CMZ, there is an additional factor established for the possibility of a shift in the stream channel. This would ensure that an established stand of trees would be available for recruitment in the relocated stream channel.

On Class II streams the RMZ buffer widths range between 100 and 130 feet (see Section 2.5, Figures 3.7-3a and b, and above discussion on shade for details regarding prescriptions), which are less than the one site-potential tree width recommended in most literature to encompass the entire source area (McDade et al., 1990; Spence et al., 1996; Murphy, 1995). When considering just the RMZ width, the 100- to 130-foot buffers would provide for most (approximately 93 and 97 percent, respectively) recruitment potential based on a mature stand (McDade et al., 1990). In some circumstances, where Class II streams have sideslopes greater than or equal to 50 percent, the RMZ would be extended to slope break, which could encompass the entire source area.

On Class III streams, harvest would be allowed to the streambank. Consequently, there would be no protection of LWD recruitment potential. PALCO would, however, be required to leave downed trees found adjacent to or within the stream. Although there would be no protection of LWD recruitment potential through leave trees, trees that did fall into the stream before the next harvest rotation would be considered recruited and, therefore, would not be removed. Currently, the contribution of LWD from Class II and III streams to Class I (fish-bearing) streams is not well understood; however, Class II streams are known to supply some LWD to the larger downstream fish-bearing streams (Potts and Anderson, 1990). Also, in Class II and III streams (like Class I streams), trees that fall into the streambed are important for sediment retention (Keller and Swanson, 1979; Sedell et al., 1988), gradient modification (Bilby, 1979), and nutrient production (Cummins, 1974) (See Section 3.7.6).

ALLOWABLE LEVEL OF ACTIVITY WITHIN THE RMZ

For Alternative 2, the 60-year-old stand found in Appendix J and its size class distribution were used as the pre-harvest stand conditions to compare to the post-harvest stand conditions in the RMZ (see Alternative 1) after implementing the target buffer prescriptions in the outer selective-harvest bands. The post-harvest target dbh size class percentages were applied to the 60-year-old stand, reducing the stand to the post-harvest square-foot basal area (Appendix J, Attachment FF-1). If the target did not exist in a given dbh size class, then the replacement size class came from the next higher dbh size class.

Three management zones are identified for Alternative 2 RMZs to compare recruitment potential for all Class I and Class II prescription scenarios. Based on the curve in Figure 3.7-2b, these zones provide the following LWD recruitment potential: zone 1 (0 to 30 feet) contributes approximately 48 percent; zone 2 (30 to 100 feet) contributes approximately 45 percent; and zone 3 contributes approximately 7 percent of LWD source trees (Appendix Table J-2 and Appendix Figures J-1a and b).

For Class I streams under the proposed strategy, no harvest would occur in the first zone (30 feet from the CMZ) and the second zone (30 to 100 feet). Approximately 93 percent of LWD recruitment potential comes from these first two zones of the RMZ, based on McDade et al. (1990) (see Figure 3.7-2b, Appendix Table J-2 and Appendix Figure J-2).

Similar to the discussion under Alternative 1, the late-seral stands probably would not have enough large trees to provide for stable LWD in larger streams and rivers. For comparison, in the 60-year-old stand described in Appendix J, approximately three trees, 40 inches in diameter, would be found per 100 feet of the stream within 100 feet from the CMZ. In one example of an old-growth stand, approximately 10 trees, 40 inches in diameter, would be found per 100 feet of the stream within 100 feet of the CMZ (see discussion under Alternative 1). As a result, the fewer recruitable large trees, the lower the chances for large tree recruitment. For a clearcut site, it could take more than 100 years to provide comparable-size trees to an old-growth stand; therefore, they would not be provided in the life of the HCP (see Table 3.7-11). With the 100-foot no-harvest band, however, the largest and oldest trees in the stand that are closest to the stream will continue to grow throughout the life span of the HCP.

Selective harvest would be allowed in the third zone (100 to 170 feet from the CMZ). The recruitment potential for the third zone is 7 percent if all source trees are left uncut (see Appendix Table J-2 and Figure J-1a). The 240-square-foot, post-harvest basal area, selective-harvest prescription in this zone would reduce the LWD recruitment potential of the RMZ by approximately 2.6 percent.

Combined, the three zones of the RMZ (which equal one site-potential tree width) would provide approximately 97.4 percent of the leave trees available for LWD recruitment based on the uncut buffer of the modeled mature (60-year-old) stand used in this analysis (see Appendix Table J-2 and Figure J-1a).

Along Class II streams under the proposed mitigation, LWD source trees remaining in the riparian zone after harvest range between 77 and 80 percent, depending on the RMZ width and the silvicultural prescription (based on the 60-year modeled stand) (see Appendix Table J-2 and Figure J-1b). As explained above, the LWD recruitment potential is greatest closer to the stream. Therefore, there is a substantial difference in LWD recruitment potential when selective harvest is allowed in zone 2 (30 to 100 feet) compared to designating zone 2 a no-harvest zone as is done under Class I streams. Class II RMZs outside the Humboldt WAA that have a 130-foot RMZ with a 30-foot, no-harvest band provide the most LWD recruitment potentials, followed by the 100-foot RMZ with a 30-foot, no-harvest band within the Humboldt WAA (which provides less source area than those outside the Humboldt WAA).

Streams with narrower buffer widths have a lower percentage of source trees left in the RMZ. Consequently, in the modeling results depicted in Appendix Table J-2 and Figure J-1b, the prescriptions outside of the Humboldt WAA (with 80 percent of the source trees remaining) have a higher number of source trees retained. As discussed above under Class I streams, zone 1 (0 to 30 feet) provides 48 percent of the source trees when no harvest occurs. Zone 2 (30 to 100 feet) provides 45 percent of the source trees if no harvest occurs. However, the 240-square-foot post-harvest basal area, selective-harvest prescription occurring in this zone would reduce the LWD recruitment potential by approximately 16 percent. For the additional 30 feet in the third zone (100 to 130 feet) along Class II streams outside the Humboldt WAA, an additional 4 percent LWD recruitment potential is lost. The greatest risk of long-term loss of LWD recruitment potential would likely occur in Douglas-fir timber types, which do not resprout or grow as fast as redwood trees.

For both Class I and II streams, pre- and post-harvest stand conditions were compared by using the modeled 60-year-old stand (Appendix Table J-2, and Appendix Figures J-1a and b). On a site-specific basis, however, the RMZ varies greatly depending on previous management practices (size and age of the stand). Two different sites may have the same pre-harvest square-foot basal area, for example, 400 square feet per acre. However, the first RMZ may have an average dbh of 16 inches, while another RMZ may have an average dbh of 40 inches. The first RMZ would have more trees than the other RMZ site, but the trees found in the first RMZ would be much smaller. To obtain the post-harvest basal area long-term targets in the second band along Class I and Class II streams (Appendix J, Attachment J-1), the first RMZ may require a short term reduction of basal area below the post-harvest basal area requirement to help develop larger trees at a faster rate. In the second RMZ, the stand could be harvested down to meet the large dbh size class targets. In this scenario, the post-harvest square-foot basal area could be met, as well as the larger dbh size class targets, but the RMZ could end up being relatively sparse overall and unable to meet the small and mid-size portions of the size class distribution. Because the property-wide strategy requires that tree size distributions be met, it is likely that harvest within both scenarios would be limited.

The EBAI for LWD, which takes into consideration both buffer width and the management activities that occur within the buffer, implies that this alternative provides the lowest level of protection overall for future recruitment of LWD (see Table 3.7-12 and Figure 3.7-4). In specific HUs, however, this alternative provides the same level of protection as Alternative 4. These HUs include Bear River, Mattole Delta, NF Mattole River, Upper NF Mattole River, Giants Ave., Larabbee Creek, Lower Eel, Sequoia, Freshwater Creek, Jacoby Creek, Salmon Creek, Butler Valley, Iaaqua Buttes, and Van Duzen. The HUs with higher values can be attributed to protection from other no-harvest areas within the project area. The riparian lands within the Reserve receive as much or more protection than Alternative 1. Alternative 2 also has MMCAs that would not be harvested under this alternative (see Section 3.10). The additional acres are included in category A—no-harvest, found in Figure 3.7-5 and Appendix Table J-3. These additional areas would be restricted from any timber harvest under this alternative throughout the life of the HCP and, therefore, would ensure full protection of LWD recruitment potential. A large proportion of these stands is old growth and, therefore, would provide optimal LWD recruitment potential over the short and long term.

Overall, under Alternative 2, RMZ default buffers should provide high protection of LWD inputs along Class I streams and moderate to high protection along Class II streams (see Table 3.7-11 and Table 3.7-13). No protection of source trees is provided to Class III streams under the prescriptions, but downed trees must be left. For Class I and Class II streams, the condition of (or seral stage in) the RMZ when the HCP is implemented would determine whether LWD recruitment potential could be met by the end of the 50-year period of the HCP (see Table 3.7-11). Because the strategy incorporates watershed analysis, basin-specific harvest prescriptions would be identified at a site-specific riparian and stream condition scale. This should provide greater protection of site-specific areas identified as having reduced levels of instream LWD or limited recruitable trees within the RMZ. For both Class I and Class II streams, the no-harvest portion of the RMZs may be modified by watershed analysis prescriptions to no more than 170 feet (horizontal measurement) and no less than

30 feet (slope measurement on each side of the watercourse). Along Class II streams, the no-cut buffers may be modified by watershed analysis and may be reduced to a minimum of 10 feet if FWS and NMFS determine it will benefit aquatic habitat or species. Based on public comments and the FESA and CESA issuance criteria, the wildlife agencies consider that additional mitigation would be appropriate to reduce the risk of potential adverse effects. These additional mitigations would further reduce the impacts as described in the Draft and Final EIS/EIR. This additional mitigation is summarized in Section 3.7.5. Detailed descriptions of the mitigation measures are provided in Appendix P.

Alternative 3 (Property-wide Selective Harvest)

Alternative 3 would provide full protection of LWD recruitment through the designated 340-foot no-harvest RMZs on Class I streams and the 170-foot no-harvest buffers on Class II streams. For the 100-foot no-harvest buffers on Class III streams, 85 to 90 percent of potential LWD trees would be protected (see Figure 3.7-2b and Appendix Table J-1). After watershed analysis is implemented, site-specific harvest prescriptions would be identified at a site-specific riparian and stream condition scale. These prescriptions would likely allow for some timber harvest within the RMZ and, therefore, could reduce the LWD recruitment potential.

For the purpose of modeling LWD recruitment potential under this alternative, no-harvest buffers for Class I streams were assumed to be 100 feet, Class II streams were 75 feet, and Class III streams were 25 feet. These adjustments were made to account for potential harvest following watershed analysis. Within the harvestable portion of the stream buffers, only selective harvest with a 240-square-foot post-harvest basal area would be allowed. As a result, for Class I and Class II streams, approximately 97 and 92 percent of the leave trees within the RMZ would remain (see Appendix Table J-2 and Appendix Figures J-1a and b). The potential reduction of no-cut buffers along Class I, II, and III streams could be greater than what is modeled after watershed analysis is implemented. However, the site-specific evaluation should provide sufficient protection to provide for adequate LWD recruitment requirements.

The EBAI for LWD (Table 3.7-11 and Figure 3.7-4) shows that this alternative provides a higher level of protection for LWD recruitment potential than Alternatives 2 or 4 and provides close to the same level of protection as the lower-range RMZ buffer widths under Alternative 1. Even though this alternative's EBAI value is lower than comparable values under the upper range of the RMZ buffer in most HUs, there are a few exceptions, including Salmon Creek and Middle Yager. The EBAI for LWD values includes a substantial number of RMZ no-cut acres protected in no-harvest residual and old-growth stands and their 600-foot buffers. These riparian lands are ensured 100 percent protection through the preservation of these stands.

The no-harvest stands are represented in Appendix Table J-3 and Figure 3.7-5 under Category A for no harvest. Except for the upper range of RMZ buffer widths under Alternative 1, Alternative 3 has the most no-cut RMZs protected from the no-harvest stands, as well as the Reserve (which is the same size as Alternative 2).

Overall, Alternative 3 would be second to the upper range of RMZ buffer widths found under Alternative 1 in providing high RMZ protection (see Figure 3.7-5). It would maintain full LWD recruitment potential in the long term along Class I and Class II streams and would provide a safety margin almost equivalent to Alternative 1 for uncontrollable factors such as blowdown. There is also a great amount of additional protection provided from the implementation of no-harvest old-growth and residual stands, and their 600-foot buffer, which provides protection equal or greater than Alternative 1 for many of the streams in the Project Area. Depending on the current condition in the RMZs, full LWD recruitment potential could be available in the short term (see Appendix J). It would be expected that within the old-growth stands an average of 10 trees 40 inches in dbh would be found per 100 feet of the stream within 100 feet of the CMZ along both Class I and II streams. Overall, Alternative 3 would be expected to have a positive effect on LWD recruitment potential over the long term and would maintain LWD recruitment potential where it is currently sufficient along all stream classes.

Alternative 4 (63,000-acre No-harvest Public Reserve)

Under Alternative 4, RMZs for Class I, II, and III streams in the PALCO HCP planning area would have the same buffer requirements and harvest restrictions as Alternative 2. Therefore, RMZ buffers would be expected to have the same level of LWD recruitment potential protection along Class I and II streams as Alternative 2.

However, this alternative has a higher EBAI for LWD value than found in Alternative 2. Even though in most HUs this alternative's EBAI values are equal to Alternative 2, there are a few exceptions, including the Eel Delta, Elk River, Lawrence Creek, Lower Yager, Middle Yager, and North Yager HUs. Although the total EBAI value in Alternative 4 is lower than Alternative 3, a few HUs have higher EBAI values in Alternative 4 than in Alternative 3. These include the Elk River, Lower Yager and North Yager HUs, and a few with values equal to Alternative 3, including the Middle Yager and Lawrence Creek. The protection of RMZs provided from the 63,000-acre Reserve accounts for the differences between Alternatives 2 and 4 and the similarities between Alternatives 3 and 4.

In summary, Alternative 4 would provide high LWD recruitment potential for the Project Area along Class I, moderate to high along Class II streams and low protection of LWD recruitment for Class III streams, while the RMZs located within the Reserve would provide complete protection. The same additional mitigation indicated for Alternative 2 would apply under Alternative 4. See Section 3.7.6 and Appendix P.

Leaf and Needle Litter

Most of the literature establishes that adequate inputs of leaf and needle litter usually would be provided by leaving approximately a 100-foot strip of trees on each side of the stream. Spence et al. (1996) concluded buffer widths of approximately 0.75 site-potential tree height or 120 feet are needed to provide full protection of leaf and litter inputs. However, stand age significantly influences detrital input to a stream system. Allochthonous detrital input was estimated to be two times as high in old-growth forests as either 30- or 60-year-old forests (Richardson, 1992) and could be as much as five times as high when compared to a clearcut forest (Bilby and Bisson, 1992). Current FPR buffer widths provide full protection along Class I streams with sideslopes exceeding 50 percent and with 150-foot buffers. They would also be sufficient when sideslopes exceed 30 percent if 100-foot buffers are implemented. CDF rules allow substantial reduction in overstory conifers (75 percent removal along Class I and II streams and 100 percent removal along Class III streams), which would likely alter the leaf litter composition. To what extent leaf and needle litter composition would be altered is difficult to determine since (1) timber harvest occurs in localized areas at varying times within a watershed; and (2) although in varying quantities, all forest seral stages provide some level of leaf and needle input.

However, coho considerations guidelines (CDF, 1998b) should provide for some added protection of leaf and needle litter.

Alternative 1 (No Action/No Project)

As noted in Section 2.5 and introduced under the sub-section above regarding shade, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA, the No Action alternative is not projected into the long-term future. In the short term, the conformance with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP- and site-specific basis. Compliance is attained by a wide variety of mitigation measures tailored to local conditions such that significant environmental effects and take of listed species are avoided. Consequently, most significant environmental effects of individual THPs are expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5 and under the sub-section above regarding shade, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long terms. Ranges of RMZs are considered qualitatively because it is expected that adequate buffer widths could differ as a result of varying conditions on PALCO lands.

Under Alternative 1, no acquisition or exchange of lands would occur. For the purpose of modeling within this alternative, no-harvest RMZs for Class I streams range between 170 and 340 feet, Class II streams range between 85 and 170 feet, and Class III streams range between 50 and 100 feet. These RMZs are measured horizontally from the edge of the channel migration zone or the vegetation transition line.

The range of RMZ widths provided to Class I streams exceeds the width recommended in the literature for providing complete protection of all potential leaf and needle litter input (based on a 0.75 site-potential tree; see Figure 3.7-2d). The upper range of protection provided to Class II streams exceeds the width recommended in the literature, and the lower range provides most of the leaf and needle litter input potential (see Figure 3.7-2d). Class III streams would maintain most (at least 70 to 90 percent) of the leaf and needle litter production potential, depending on whether the RMZ width provided is at the upper or lower end of the range. For all three stream classes, the RMZ buffer would be sufficient to maintain most if not all of the detrital inputs necessary for a properly functioning aquatic system.

Approximately 31,060 to 58,811 acres of no-harvest RMZs would be protected under Alternative 1 on PALCO ownership. Currently most (73 percent) of the riparian vegetation is mid-seral stage or older (more than 20 years) (see Tables 3.7-8 and 3.7-11). Stand age significantly influences detrital input to a stream system. Richardson (1992) found that allochthonous detrital input was approximately twice as high in old-growth forests as compared to either 30- or 60-year-old forests. Although some reduced level of detrital input is produced from younger stands, it can be assumed that these mid-seral stands (which make up 30 percent of PALCO's ownership) would produce leaf and needle litter at a level close, if not equal, to an old-growth forest near the end of the 50-year period of the HCP (see Table 3.7-11). Most of the younger stands would have matured to at least mid-seral stand age and, therefore, would produce at least 50 percent of the allochthonous detrital input in the later years of the HCP. This prediction is supported by the FREIGHTS model, which characterizes all of the RMZ acres (not including naturally sparse vegetation types) into at least the mid-successional category within the long term (50 years) (Appendix Table J-4). Alternative 1 would be expected to provide high if not complete protection of leaf and needle inputs over the long term when trees in RMZs grow back and over the short term where RMZs are already providing sufficient leaf and needle litter inputs.

Alternatives 2 (Proposed Action/ Proposed Project) and 2a (No Elk River Property)

As discussed previously, there are two separate ways aquatic mitigation measures are applied that directly affect the riparian area. These include property-wide prescriptions and prescriptions generated from watershed analysis. Watershed analysis does not target detrital production. Therefore, only through site-specific prescriptions that target other riparian functions would detritus production be protected. The property-wide prescriptions that apply to the riparian zone are analyzed in terms of protection levels for detritus production. In the following section, this analysis is based on the width of the RMZ and the allowable level of activity within that RMZ for Class I, II, and III streams.

Under Alternative 2, the RMZ widths for Class I and most Class II streams meet or exceed the widths recommended in the literature for protection of detritus production. Where RMZs exceed the widths recommended, the extra margin offsets risks to habitat from unknown or uncontrollable factors, such as blowdown. A no-harvest band closest to the stream of 100 feet on all Class I and 30 feet on all Class II streams maintain a large proportion of the RMZ's detrital input productive capacity (see Section 2.5, Figures 3.7-3a and b, and above discussion on shade for details regarding prescriptions). The only exception might be where measures to provide ecosystem restoration are implemented (e.g., tree thinning). In this scenario, thinning trees in the first 30 feet could reduce some of the leaf and needle input potential for the short term.

Under the property-wide strategy, silvicultural activities in the selective-harvest, second-band, 240 square-foot, post-harvest basal area on Class I and II streams would not appreciably reduce the ability of the RMZ to contribute detrital nutrients, especially when combined with the no-harvest band. These RMZs would provide continuous inputs of detritus to streams and would allow the maintenance of stream productivity in the short and long term.

There is one prescription scenario along Class II streams where protection of detrital inputs is not as complete. This scenario is where the RMZ width is 100 feet, which is less than that recommended in all of the literature, although many studies conclude that 100 feet is sufficient to provide detritus production. This scenario occurs along Class II streams in the Humboldt WAA. In this scenario, the risk of leaf and needle litter declines from this prescription is low since it maintains most of the overstory canopy (80 percent or greater), and the RMZ buffer width is close to the width recommended in literature.

Richardson (1992) estimated that 70 to 94 percent of all leaves that enter a stream segment are transported downstream until stored in a large pool or lake. This finding suggests that some detrital input from upper headwater areas that may not have fish (i.e., Class II and III streams) likely contributes to lower downstream segments that support fish. The overall importance and magnitude of this upstream contribution to detrital input is not currently known. The exact proportion of detrital production that comes from Class III streams is not well documented in the literature; however, it may be an important portion of the overall productivity. On

Class III streams, the lack of RMZ buffers would not meet the protection recommended for detrital input needs, at least in the short term, and probably only in localized areas while vegetation grows back. There would probably be an interruption of detritus input until the riparian forest regrew to the point of canopy closure, after the Class III stream was harvested. The Class III streams would then produce some leaf and needle litter, although production might not reach the level of a late seral stand in the short (10 years) or long term (50 years).

Currently, 43 percent of the riparian vegetation is in mid-seral stage (20 to 50 years), and 16 percent is in the early seral stages (see Table 3.7-8). Stand age significantly influences detrital input to a stream system. Therefore, these stands would not be producing leaf and needle litter that approach natural background levels in the short term (see Table 3.7-11). Mid-seral stands would regrow to the point that canopy closure would be sufficient to produce leaf and needle litter comparable to a late seral stand near the end of the 50-year period of the HCP along Class I and II streams (see Table 3.7-11 and Appendix Table J-4).

Alternative 2 would protect most leaf and needle litter potential in Class I and II streams for both the short and long term under the property-wide prescriptions. The lack of protection of Class III streams would reduce leaf and litter input potential in both the short and long term. This could affect future leaf and needle input rates. Potentially, because of the loss of Class III leaf and needle inputs, an eventual slowdown in overall inputs downstream of Class III streams could occur. This could affect productivity downstream in fish-bearing waters. As a result, Alternative 2 is expected to provide complete protection of leaf and needle inputs along Class I streams and high protection along Class II streams. Along Class III streams, however, Alternative 2 would not provide protection of detrital inputs. Therefore, there is a greater risk of interrupting detrital inputs over the short and long term until new trees grow back in localized areas (see Table 3.7-11).

Under this alternative, riparian acres within the Reserve and MMCAs are provided complete protection from any loss of riparian function for inputs of leaf and needle litter. The MMCA acres are included under Category A— no harvest, found in Appendix Table J-3 and Figure 3.7-5.

Based on public comments and the FESA and CESA issuance criteria, the wildlife agencies consider that additional mitigation would be appropriate to reduce the risk of potential adverse effects. These additional mitigations would further reduce the impacts as described in the Draft and Final EIS/EIR. This additional mitigation is summarized in Section 3.7.5. Detailed descriptions of the mitigation measures are provided in Appendix P.

Alternative 3 (Property-wide Selective Harvest)

Under Alternative 3, complete protection of potential leaf and needle input would be provided by the designated 340-foot no-harvest RMZs on Class I streams, 170-foot, no-harvest RMZs on Class II streams, and 100-foot no-harvest RMZs on Class III streams. Selective harvest within the RMZs could occur after watershed analysis is implemented and site-specific harvest prescriptions are identified. Because it is anticipated that the no-harvest RMZs would be reduced after watershed analysis, the following buffers were assumed for modeling: no-harvest buffers for Class I streams are 100 feet, Class II streams are 75 feet, and Class III streams are 25 feet. Within the harvestable portion of the stream buffers, only selective harvest of a 240 square-foot Post-harvest Basal Area (PHBA) (following the same size distribution as explained in Alternative 2) would be allowed. Overall, the RMZ buffers provided on all three stream classes should be sufficient to maintain the detrital inputs on all streams at or near natural conditions.

Also, under this alternative, the RMZ acres that are protected from the combination of the no-harvest residual and old growth and the 600-foot buffers surrounding them are ensured complete protection through the preservation of these stands. These stands are represented in Appendix Table J-2 and Figure 3.7-5 under Category A—no harvest. Except for the upper range of RMZ buffer widths under Alternative 1, this alternative has the greatest amount of acres protected by no-harvest RMZs among the alternatives.

Alternative 3 would ultimately provide the most RMZ protection for leaf and needle litter overall (except for Alternative 1) (see Figures 3.7-3 a, b, and c). It should maintain adequate leaf and needle litter close to what would be found in an old-growth stand throughout PALCO's ownership and would provide for an extra margin that is almost equivalent to Alternative 1 for uncontrollable factors such as blowdown. As a result, this alternative should provide complete protection of detrital inputs needed for the aquatic environment (see Section 3.8).

Currently, most (73 percent) of the riparian vegetation in the PALCO HCP planning area is at least in mid-seral stage (20 to 50 years) (see Table 3.7-8). Because stand age and density significantly influence detrital input to a stream system, some reduced level of detrital input is expected from younger stands. Therefore, it can be assumed that these mid-seral stands (which make up 36 percent of the ownership) would be producing leaf and needle litter at a level close, if not equal, to a natural system by the end of the 60-year period of the HCP. Most of the younger stands would have grown up to at least mid-seral stand age and, therefore, would be producing at least 50 percent of the allochthonous detrital input in the later years of the HCP (Table J-4).

Alternative 4 (63,000-acre No-harvest Public Reserve)

Alternative 4 RMZs for Class I, II, and III streams in the PALCO HCP planning area would follow the same buffer requirements and harvest restrictions as Alternative 2. As a result, the same conclusion can be made: RMZs would provide most, if not all, protection of leaf and needle litter to Class I and II streams and would have a high risk of reduction along Class III streams.

This alternative provides substantive additional protection of RMZs due to the more than 63,000-acre Reserve. This alternative has a greater number of no-harvest RMZ lands than Alternative 2. The protection of RMZs provided by this Reserve is, however, a smaller portion of no-cut RMZ acres in this alternative than in Alternative 3. Overall, Alternative 3 gains more protection from the proposed implementation of a 600-foot buffer around the residual and old growth than the 63,000-acre Reserve under Alternative 4.

In summary, Alternative 4 maintains most of the full potential for leaf and needle litter input from RMZs for two reasons: (1) the RMZ buffers protect most of the leaf and needle input on PALCO's land in Class I and II streams for both the short and long term; (2) the RMZs located within the Reserve would have complete protection of detrital inputs. However, the lack of protection of Class III streams outside of the Reserve could reduce leaf and litter input potential in both the short and long term in localized areas.

The same additional mitigation as indicated for Alternative 2 would apply under Alternative 4. See Section 3.7.6 and Appendix P.

Streambank Stability

Streambank erosion is a natural process that occurs sporadically in forested and nonforested watersheds (Richards, 1982; Thorne, 1982). Under natural conditions, this process is part of the normal equilibrium of streams. The forces of erosion (water), resistance (root strength and bank material), and sediment transport maintain an important balance. Human activity can accelerate streambank erosion. Important alterations of the system components that typically result from timber harvest activities include the following: (1) removing trees from or near the streambank; (2) changing the hydrology of the watershed; and (3) increasing the sediment load, which fills pools and contributes to lateral scour by forcing erosive stream flow against the streambank (Pfankuch, 1975; Cederholm et al., 1978; Chamberlin et al., 1991). This evaluation is based on the widths of the respective RMZs and activities allowed within the buffer that may affect root strength and, thus, streambank integrity. Changes in hydrology and increases in sediment load that affect bank stability are addressed in Section 3.4.

For this analysis, a conservative 0.5 site-potential tree is assumed to provide complete protection of bank stability (Spence et al., 1996). For FPRs, full protection is provided on Class I streams greater than 30 percent slope and Class II streams greater than 50 percent slope. Because FPRs allow some harvest within the riparian zone, bank stability may be further reduced. No-harvest zones immediately adjacent to channels provide an additional measure of protection to bank integrity. In the coho consideration guidelines (CDF, 1998b), no harvest within 0.3 tree height is suggested along Class I and II streams to maintain streambank integrity, particularly along streambanks that show lack of stability. When implemented, coho considerations should provide most of the protection required to maintain bank stability along Class I and II streams. Limited protection is given to Class III streambanks through ELZs.

Alternative 1 (No Action/No Project)

As noted in Section 2.5 and introduced under the sub-section above regarding shade, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA, the No Action alternative is not projected into the long-term future. In the short term, conformance with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP- and site-specific basis. Compliance is attained by a wide variety of mitigation measures tailored to local conditions such that significant environmental effects and take of listed species are avoided. Consequently, most significant environmental effects of individual THPs are expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5 and under the sub-section above regarding shade, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs, as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long term. Ranges of RMZs are considered qualitatively because adequate buffer widths could differ as a result of varying conditions on PALCO lands.

Under Alternative 1, no acquisition or transfer of lands would occur. For the purpose of modeling within this alternative, no-harvest RMZs for Class I streams range between 170 and 340 feet, Class II streams range between 85 and 170 feet, and Class III streams range between 50 and 100 feet. These RMZs are measured horizontally from the edge of the channel migration zone or the vegetation transition line.

Alternative 1 provides complete protection for this function along all Class I and II streams and the upper end of the range of RMZs for Class III streams. The lower end of the range for Class III streams (50-foot no-harvest RMZs) provides most of the protection required to maintain bank stability. Class III streams are also much smaller, tend to be moderately or highly confined, and have less erosive power; therefore, they do not necessarily require such expansive buffers for bank stability protection. However, some Class III streams are susceptible to other processes such as mass wasting and peak flows which could also affect bank stability (see Sections 3.4 and 3.6). Therefore, most of these RMZ buffers meet the 0.5 site-potential tree width and also provide complete protection by providing no-harvest zones immediately adjacent to the stream. With the one exception, Class III streams with RMZ buffer widths of 50 feet, a high level of protection would be provided to maintain streambank stability.

Alternatives 2 (Proposed Action/ Proposed Project) and 2a (No Elk River Property)

As discussed previously, there are two separate ways aquatic mitigation measures are applied that directly affect the riparian area. These are property-wide prescriptions and prescriptions generated from watershed analysis. In this section, the property-wide prescriptions that apply to the riparian zone are analyzed in terms of protection levels for streambank stability. This analysis is based on the width of the RMZ and the allowable level of activity within that RMZ for Class I, II, and III streams.

Management of riparian lands is the same under Alternatives 2 and 2a. (See Section 2.5, Table 2.6-2, Figures 3.7-3a and b, and above discussion on shade for details regarding prescriptions). The RMZ width measurement on Class I and II streams exceeds the width recommended in the literature for streambank stability (see Figure 3.7-2d). Class III streams are not provided with RMZs (see Section 3.4).

The 100-foot-wide, no-harvest band combined with a selective harvest band within Class I RMZs and the 30-foot-wide, no-harvest band combined with a selective harvest band within Class II RMZs should provide complete protection of streambank stability.

For Class III streams, complete harvest to the stream edge does not provide protection of streambank stability through the maintenance of tree root strength. Although many redwood stumps resprout (69 to 90 percent), there are no studies to support that bank stability is protected during the root dieback process. Stump sprouts do not require the same amount of root density to support young growth. As a result, much of the root system will die back over the short term and not return to pre-harvest root density until at least the long term (see Table 3.7-11). Therefore, in redwood timber type zones during the short and long term, root strength of harvested trees should maintain bank integrity (see Section 3.7.4.1). However, in the 5 to 11 years after timber harvest, there is a greater risk that streambank stability could be compromised from harvesting trees along the streambank. This is the period where the greatest amount of root dieback has occurred and regrowth is just beginning.

Compared to the redwood timber type zones, Douglas-fir timber type stands have root dieback at a faster rate when harvested, and root regeneration does not occur. Therefore, the risk of reduced protection of streambank stability from root strength after harvesting trees close to the streambank in Douglas-fir stands may occur before, and last longer than, the 5 to 11 years predicted above. Class III streams are provided some protection to the streambank through ELZs and EEZs and by leaving all downed wood within the ELZs and EEZs.

In summary, all streambank stability along Class I and II streams should be protected. In the HCP, the bank stability of Class III streams may be reduced because of the lack of guaranteed protection of root strength (see Section 3.4). When watersheds are analyzed, site-specific areas prone to bank erosion should include added protection, even if the stream is Class III. Based on public comments and FESA and CESA issuance criteria, the wildlife agencies consider that additional mitigation would be appropriate to reduce the risk of potential adverse effects. These additional mitigations would further reduce the impacts as described in the Draft and Final EIS/EIR. This additional mitigation is summarized in Section 3.7.5. Detailed descriptions of the mitigation measures are provided in Appendix P.

Alternative 3 (Property-wide Selective Harvest)

Alternative 3 provides complete protection of streambank stability along all streams. All RMZs meet the 0.5 site-potential tree width and also provide complete protection by providing sufficient no-harvest bands immediately adjacent to the stream.

Alternative 4 (63,000-acre No-harvest Public Reserve)

Alternative 4 provides complete protection for streambank stability along Class I and II streams, similar to Alternative 2. All Class I and II RMZs meet the 0.5 site-potential tree width. For all Class I and II streams, no-harvest zones immediately adjacent to the stream provide full protection potential. For Class III streams, complete harvest to the stream edge does not provide protection of streambank stability. However, watershed analysis should target sensitive areas that may require added protection. The same additional mitigation indicated for Alternative 2 would apply under Alternative 4. See Section 3.7.5 and Appendix P.

Sediment Control

Fine sediment that is transported over land can be filtered out by streamside buffer strips. The ability of streamside buffer strips to capture fine sediment depends largely on their width and slope. Thus, buffer-strip width is an important parameter for evaluating the ability of a management option to avoid excessive fine sediment delivery to streams. Recommended buffer widths for sediment removal vary widely (see discussion in Section 3.7.4.1). Studies of forest watersheds recommend buffers of approximately 100 feet for this purpose (Johnson and Ryba, 1992). Considering only fine sediments generated by surface erosion within the riparian zone, buffers of approximately one site-potential tree are recommended by Spence et al. (1996) as being effective in trapping most sediments, provided that slopes are not too steep. Spence et al. (1996) states that on gentle slopes, buffers narrower than one site-potential tree are probably sufficient to remove most sediments. Additionally, other BMPs in the RMZ can prevent or minimize sediment that reaches the stream.

California has explicit rules for increasing buffer widths based on slope steepness (see Table 3.7-10 and Figures 3.7-3a, b, and c). Class I streams meet the recommended buffer width for slopes greater than or equal to a 30 percent slope. Class I streams on sideslopes less than 30 percent do not meet the required 100-foot buffer strip recommended in most literature. However, FPRs have explicit requirements for retaining groundcover or downed wood, both of which reduce the impact of management activities on sediment retention capability. California requires retention of at least 75 percent surface cover within the riparian zone (see Table 3.7-10) and treatment (mulching, seeding, riprap, chemical stabilizers) of larger bare patches created by forest practices.

FPRs for Class II streams appear to provide limited protection of sediment control. On Class II streams, FPRs approach the recommended width by requiring 50- to 100-foot buffers, depending on sideslope class. A high level of timber harvest within the buffers can compromise their effectiveness as sediment filters (Murphy, 1995). As explained above, however, FPRs have explicit requirements for retaining groundcover or downed wood, retaining a minimum of 75 percent surface cover within the riparian zone, and treating bare patches created by forest practices.

No RMZ is established along Class III streams; therefore, no level of protection is provided through the implementation of buffer width as discussed above by FPRs. These streams are extremely important in controlling fine sediment delivery because of their greater density (over 50 percent of the total length of stream channels in a watershed) (Spence et al., 1996). For coarse sediment delivery, primarily from mass wasting events, see Section 3.6. Coho considerations (CDF, 1998b) address Class III sediment delivery potential by establishing guidelines that state “activities should not cause soil disturbance within or cause sediment movement into the channel of Class III streams and LWD within the channel should not be harvested. Also, establish ELZs where necessary, with specific crossing location to avoid generation of sediment.” Factors (other than sediment that is transported overland) that influence the delivery of excessive sediment to streams are discussed in Section 3.6. Also included in Section 3.6 is additional discussion on sediment reduction guidelines provided from FPR and coho considerations (e.g., erosion control on skid trails).

Activities within the riparian zone that disturb or compact soils, destroy organic litter, and remove large downed wood can reduce the effectiveness of the riparian buffers as a sediment filter. Burning within the riparian zone is one such action that can reduce or diminish buffer effectiveness in the short term until a new duff and vegetation layer regrows. Throughout PALCO's land, prescription burns are implemented after harvest takes place (see Section 3.6). Although fires are not prescribed in the RMZ, incidental burning occurs within them when adjacent prescribed burns escape into the RMZ. Under all alternatives, the risk of fire in RMZs managed by PALCO would be similar. Overall, the effects of fire in all alternatives would have a short-term potential impact of reduced sediment filtration until a new vegetation and duff layer develops (approximately five years).

Alternative 1 (No Action/No Project)

As noted in Section 2.5 and introduced under the sub-section above regarding shade, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA the No Action alternative is not projected into the long-term future. In the short term, conformity with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP- and site-specific basis. Compliance is attained by a wide variety of mitigation measures tailored to local conditions such that significant environmental effects and take of listed species are avoided. Consequently, most significant environmental effects of individual THPs are expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5 and under the sub-section above regarding shade, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs, as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long term. Ranges of RMZs are considered qualitatively because it is expected that adequate buffer widths could vary as a result of varying conditions on PALCO lands.

Therefore, for the purpose of modeling within this alternative, no-harvest RMZs for Class I streams would range between 170 and 340 feet, Class II streams would range between 85 and 170 feet, and Class III streams would range between 50 and 100 feet. These RMZs are measured horizontally from the edge of the channel migration zone or the vegetation transition line.

The main protection measure of Alternative 1 would be the creation of large no-harvest buffers on all streams. Class I RMZs and the upper-range RMZs of Class II and III streams would meet or exceed widths recommended in literature (see Section 3.7.4.) to control sediments from overland flow. Both the width of the buffer and the fact that there would be no management activities in the RMZ would ensure that the function affording the most sediment filtering is maintained. Also, because the buffer is measured horizontally, steeper areas would gain greater distance for filtration, thus ensuring even greater protection.

The lower-range RMZs for Class II and Class III streams would not meet the recommended widths found in literature and would, therefore, be more susceptible to sediment inputs. Because of the two points listed above, however, (no management activities would occur in the RMZ, limiting sediment generation within it and maximizing its efficiency for filtering out upland sediment, and the buffer would be measured horizontally, providing steeper areas and greater distance for filtration), the reduced width of the RMZ should be fairly effective in filtering out sediment. The Class III streams with the 50-foot no-harvest buffer would have the greatest risk of limited sediment filtering capacity.

The upper-range RMZs under Alternative 1 would have the second highest sediment EBAI value overall when comparing the upper range of protection to all other alternatives (second to Alternative 3). The overall value for the lower range RMZs under Alternative 1 would drop below all the other alternatives. Alternative 3 would receive greater protection along more Class II and III streams from no harvest of residual and old-growth stands and an added 600-foot buffer that would surround these stands. The lower range RMZs for Alternative 1 would provide greater protection to streams in Larabee, Lower Eel, Freshwater, and Van Duzen, compared to Alternative 2, primarily from no harvest of occupied marbled murrelet stands. Overall, Alternative 1 would provide a high level of protection of sediment-filtering functions for the upper range of RMZs along all stream classes (Figure 3.6-6 in Section 3.6) and a high-to-moderate level of protection for the lower range of RMZs (see Table 3.7-13).

Alternative 2 (Proposed Action/Proposed Project) and 2a (No Elk River Property)

As discussed previously, there are two separate ways aquatic mitigation measures would be applied that directly affect the riparian area. These include the property-wide strategy and the prescriptions generated from watershed analysis. In this section, the property-wide prescriptions that would apply to the riparian zone are analyzed in terms of protection levels for sediment filtration. This analysis is based on the width of the RMZs and the allowable level of activity within that RMZ for Class I, II, and III streams.

RMZs for Class I and II streams under the property-wide prescriptions would meet or exceed the range of widths recommended in literature for protection of sediment filtration (see Section 2.5, Figures 3.7-3a and b, and above discussion on shade for details regarding prescriptions). The 100-

foot, no-harvest band within Class I stream RMZs, combined with a 70-foot, selective-harvest band, should provide high protection of riparian sediment filtering capacity. Timber harvest within 100 feet of Class II streams might reduce their effectiveness as sediment filters (Murphy, 1995). Because the RMZ closest to the stream on all Class II streams would be a no-harvest area, filtration capacity would be maximized in the first 30 feet from the stream. In the selective timber harvest bands along Class II streams, safeguards would be in place to reduce the risk of compromising fine sediment filtering capacity in this portion of the RMZ. These safeguards include the following:

- PALCO would not be allowed to salvage dead and dying trees.
- PALCO would be required to treat all areas with 100 or more square feet of exposed mineral soils and all areas with less than 100 square feet of exposed mineral soils on sideslopes greater than 30 percent if the site could deliver fine sediment to the watercourse.
- PALCO would be allowed only limited entry of no more than once every 20 years.

For almost all forestry activities, as hillslope gradient increases, the potential for delivering sediment into streams increases (Murphy, 1995). Most of this risk comes from the increased potential of mass wasting events (see Section 3.4). The steeper the sideslopes, however, the greater the potential to have fine sediment from rills or small gullies reach the stream. Along both Class I and II streams with sideslopes greater than 50 percent, therefore, increased protection of the RMZ sediment filtration capacity would be provided under the property-wide RMZ prescriptions. This protection would be obtained by extending the outer selective harvest band to the break-in-slope or upslope to a distance of 400 feet (e.g., along Class I streams, the calculation would be 170 feet plus an additional 230 feet for a total of 400 feet), whichever is less.

An RMZ buffer would not be provided for Class III streams under the property-wide strategy. There would be, however, an ELZ of 25 feet on slopes less than 30 percent, an ELZ of 50 feet on slopes between 30 and 50 percent, and an EEZ of 100 feet on slopes greater than 50 percent (see Figure 3.7-3c). No fire ignition would be allowed in these ELZs or EEZs. Downed trees would not be removed within these zones. In ELZs and EEZs with exposed mineral soils of 100 or more square feet or sites with less than 100 square feet of exposed mineral soils on sideslopes greater than 30 percent, the areas would be treated. Many of these provisions are recommended under coho considerations as well. These requirements would reduce fine sediment inputs to Class III streams, but it is difficult to estimate how much fine sediment reduction would be provided from these restrictions. These restrictions would, however, provide more protection to Class III streams than found under FPRs (not including coho considerations). During the short term, however, Class III streams would have the greatest risk of reducing sediment filtering capabilities. A return to more favorable conditions would occur when a new vegetation and duff layer was developed in impacted areas. This process would take approximately 5 years (see Table 3.7-11).

The overall sediment EBAI for Alternative 2 is lower than all alternatives, except for the lower range RMZ widths under Alternative 1 (Figure 3.6-6). This indicates that sediment filtration effectiveness in this alternative would not be as protective as most of the other alternatives. However, in individual HUs, Alternative 2 would have the same protection level or greater protection levels when compared to the other alternatives. For example, under Alternative 4, which has the same RMZ protection as Alternative 2, many of the

HUs would have the same EBAI values. Alternative 4 would have greater levels of protection from streams located in the 63,000-acre Reserve. Also, Alternative 2 would have a greater value than the upper range modeled in Alternative 1 in Salmon Creek due to the protection provided from the Reserve. The riparian lands within the Reserve would receive as much or more protection than Alternative 1. Alternative 2 would also have additional riparian acres in MMCAs that would not be harvested under this alternative (see Section 3.6). As a result, the additional acres would be included in category A—no harvest, found in Figure 3.7-5 and Appendix Table J-3. These additional areas would be restricted from timber harvest under this alternative and would ensure complete protection potential from any loss of riparian function from management-induced sediment inputs.

Overall, under Alternative 2, RMZ buffers should provide high protection of sediment filtration capacity along Class I and Class II streams (see Table 3.7-13) and should improve overall sediment filtration effectiveness compared to current conditions (see Table 3.7-11). Along Class III streams, protection would be low-to-moderate on a localized basis for the short term.

For the HCP aquatic strategy, the results of any watershed analysis would be applied or the property-wide prescriptions would be applied. As a result, basin-specific harvest prescriptions would be identified at a site-specific riparian and stream condition scale. This should contribute to increasing protection from fine sediment inputs in sensitive areas within the RMZ (including along Class III streams). For both Class I and Class II streams, the no-harvest portion of the RMZs may be modified by watershed analysis prescriptions to no more than 170 feet (horizontal measurement) and no less than 30 feet (slope measurement on each side of the watercourse). Along Class II streams, the no-cut buffers may be modified by watershed analysis and may be reduced to a minimum of 10 feet if FWS and NMFS determine it will benefit aquatic habitat or species.

Based on public comments and FESA and CESA issuance criteria, the wildlife agencies consider that additional mitigation would be appropriate to reduce the risk of potential adverse effects. These additional mitigation measures would further reduce the impacts as described in the Draft and Final EIS/EIR. This additional mitigation is summarized in Section 3.7.5. Detailed descriptions of the mitigation measures are provided in Appendix P.

Alternative 3 (Property-wide Selective Harvest)

The main protection measure of Alternative 3, prior to watershed analysis, would be the creation of large no-harvest buffers on all streams similar to Alternative 1. Similar to Alternative 1, these RMZs would meet or exceed the widths recommended in literature for filtering sediment. After the watershed analysis, the predicted no-harvest buffer for all stream classes within PALCO ownership, in addition to the selective harvest of the remaining property, would be expected to provide more protection than RMZs under Alternative 2. The RMZs provided on Class I and II streams would be sufficient to maintain riparian function for sediment filtering at or near the natural disturbance regime. On Class III streams, there might be some reduction of the buffer's capacity to filter sediment due to some allowed management within 100 feet of the stream. Overall, Alternative 3 should provide high protection to Class I, II, and III streams and would not be expected to affect the RMZs' sediment filtering function.

Using the sediment EBAI as a comparative tool (see Section 3.6 for description of sediment EBAI and Figure 3.6-6), overall this alternative would be the most protective of the sediment filtering function, compared to other alternatives. In many HUs, complete protection would be provided to all streams throughout the residual old growth and old-growth stands that would not be harvested and to the no-harvest 600-foot buffers around these stands (Section 2.4). When looking specifically at each HU within the planning area, Alternative 3 would have the highest value with just a few exceptions including Giants Avenue, Freshwater Creek, Elk River, Lawrence Creek, Lower Yager, Middle Yager, and North Yager. In these HUs, Alternative 3 EBAI values are lower than the EBAI values found under either Alternative 1 or Alternative 4. Ultimately, Alternative 3 would provide the most RMZ protection over all.

Alternative 4 (63,000-acre No-harvest Public Reserve)

Alternative 4 RMZs for Class I, II, and III streams in the PALCO HCP planning area would follow the same buffer requirements and harvest restrictions as Alternative 2. As a result, the same conclusion can be drawn. RMZ buffers on all Class I and II streams would be sufficient to maintain high riparian function for sediment filtering. On Class III streams, an RMZ buffer would not be provided. There would, however, be an ELZ of 25 feet on slopes less than 30 percent, and an ELZ of 50 feet on slopes between 30 and 50 percent, and an EEZ of 100 feet on slopes greater than 50 percent (see Figure 3.7-3c). No fire ignition would be allowed in these ELZs or EEZs, and downed trees would not be removed within these zones. These specific requirements would reduce sediment inputs to Class III streams. Therefore, protection would be low to moderate.

The results of any watershed analysis done (if implemented) would be applied. As a result, basin-specific harvest prescriptions would be identified at a site-specific riparian and stream condition scale. This should contribute to increasing protection from fine sediment inputs in sensitive areas within the RMZ (including Class III streams).

This alternative would have a greater overall EBAI value than Alternative 2**.** Even though in most HUs, this alternative's EBAI value would be lower than in Alternative 3, there are a few exceptions (Elk River, Lawrence Creek, Lower Yager, Middle Yager and North Yager) where the EBAI value would be greater than Alternative 3, (Figure 3.6-6). The protection of RMZs provided from the 63,000-acre Reserve explains the increased protection in some HUs as compared to Alternative 3.

The same additional mitigation indicated for Alternative 2 would apply under Alternative 4 (see Section 3.7.5 and Appendix P).

Microclimate

Riparian microclimatic conditions are essential for some wildlife species (see Section 3.10). To avoid significantly altering the microclimate of a riparian zone, Ledwith (1996) recommends leaving buffer strips over 100 feet wide. Buffers wider than 100 feet would still affect the microclimate, but at a lower rate of change (Ledwith, 1996). Of all the components that make up the microclimate, humidity has the greatest influence. It was selected for this evaluation because it provides the most conservative basis for evaluating the alternatives. Based on studies by Chen (1991) and Chen et al. (1993), humidity reached interior old-growth conditions at a distance of 575 feet from the edge of a clearcut.

FEMAT (1993), based on studies from Chen (1991), suggests as many as three site-potential trees are needed to provide complete protection of riparian microclimate (see Figure 3.7-2e). Research is not available to allow prediction of the buffer strip width adequate to provide satisfactory protection of microclimate. FPRs list microclimate modification as one potential wildlife concern to be evaluated and, therefore, currently provide a low level of protection from harvest activities over the long term. By definition, Class III streams do not have aquatic life (Table 3.7-13). Therefore, protection of riparian microclimate was not evaluated for Class III streams.

Alternative 1 (No Action/No Project)

The state and federal assumptions for assessing environmental impacts to aquatic resources under the No Action/No Project alternative differ due to differences in analysis approach required by CEQA and NEPA. CEQA implementing regulations require that an EIR discuss "the existing conditions, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved" (14 CCR 15126[d][4]). CEQA does not require either a projection into the long-term future that could be deemed to be speculative, nor does it require a quantitative analysis of the No Project alternative for comparison with the other alternatives. Accordingly, the state version of the No Action/No Project alternative analyzed here contemplates only the short term and is based on individual THPs that would be evaluated case by case. The CDF version of No Action/No Project does not attempt to forecast how PALCO's entire property would look in 50 years (the length of the proposed ITP). Since it is unknown how many THPs there would be, where they would lie geographically, and how they would differ in detail, no quantitative analysis of THPs is presented (see Section 2.5).

The likely No Action/No Project alternative would consist of PALCO operating in a manner similar to current THP practices and subject to existing CDF regulatory authority. In reviewing individual THPs, CDF is required to comply with the FPA, FPRs, and CEQA through its certified functional equivalent program (see Section 1.6). The specific criteria for evaluating THPs contained in the FPRs are combined with the case-by-case evaluation of each THP for significant effects on the environment followed by consideration of alternatives and mitigation measures to substantially lessen those effects. Under CEQA and the FPRs, CDF must not approve a project including a THP as proposed if it would cause a significant effect on the environment and there is a feasible alternative or feasible mitigation measure available to avoid or mitigate the effect. An adverse effect on a listed threatened or endangered species would be a significant effect under CEQA.

In addition, the present FPRs provide that the Director of CDF shall disapprove a timber harvesting plan as not conforming to the rules if, among other things, the plan would result in either a taking or a finding of jeopardy of wildlife species listed as rare, threatened, or endangered by the Fish and Game Commission or a federal fish or wildlife agency or would cause significant, long-term damage to listed species. To make a determination as to the effect of a THP on listed fish or wildlife species, CDF routinely consults with other state agencies and notifies federal fish and wildlife agencies. These processes and independent internal review by CDF biologists can result in a THP containing additional site-specific mitigation measures similar to the ones described in the Proposed Action/Proposed Project alternative. CDF believes that its existing process using the FPRs and the CEQA THP by THP review and mitigation are sufficient to avoid take of listed species.

The mitigation by which an individual THP is determined to comply with FPRs, the FESA and CESA, and other federal and state laws is determined first by compliance with specific standards in the FPRs and then by development of site-specific mitigation measures in response to significant effects identified in the CEQA functional equivalent environmental analysis of the individual THP. Compliance is attained by a wide variety of detailed mitigation measures tailored to local conditions including, but not limited to, consideration of slope stability, erosion hazard, road and skid trail location, WLPZ width, BMPs on hillslopes and within WLPZs, and wildlife and fish habitat. Consequently, most significant effects of individual THPs can be expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative. In some cases, CDF may determine that it is not feasible to mitigate a significant effect of a THP to a level of less than significant. In such a situation, CDF would need to determine whether specific provisions of the FPRs such as not allowing take of a listed threatened or endangered species would prohibit CDF from approving the THP. If approval is not specifically prohibited, CDF would need to weigh a variety of potentially competing public policies in deciding whether to approve the THP. A THP with a significant remaining effect could be approved with a statement of overriding considerations, but such an approval would be expected to be rare.

As noted in Section 2.5, under NEPA the degree of analysis devoted to each alternative in the EIS will be substantially similar to that devoted to the Proposed Action/Proposed Project. The federal agencies recognize that a wide variety of potential strategies could be applied that could represent a No Action/No Project scenario and that they would involve consideration of the same mitigation measures as described above. For the purposes of analysis under NEPA, however, these additional mitigation measures are represented as RMZs, rather than management options developed for site-specific conditions. Consequently, the analysis of the No Action/No Project alternative considers the implementation of wide, no-harvest RMZs as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long term. Ranges of RMZ width are considered qualitatively because adequate buffer widths could vary as a result of varying conditions on PALCO lands.

As noted above, the evaluation of the No Action/No Project differs under CEQA and NEPA. For CEQA the No Action alternative is not projected into the long-term future. In the short term, the conformance with the FPRs, the FESA and CESA, and other federal and state laws is determined on a THP- and site-specific basis. A wide variety of mitigation measures tailored to local conditions is applied with the purpose of avoiding significant environmental effects and take of listed species. Consequently, most significant environmental effects of individual THPs can be expected to be mitigated to a level of less than significant through implementation of the No Action/No Project alternative.

As noted in Section 2.5 and Section 3.4.3.2, the NEPA evaluation of the No Action alternative considers the implementation of wide, no-harvest RMZs as well as restrictions on the harvest of old-growth redwood forest to model conditions over the short and long term. Ranges of RMZs are considered qualitatively because adequate buffer widths could vary as a result of varying conditions on PALCO lands.

RMZ buffers would provide some level of protection of riparian microclimate on Class I streams. However, because of insufficient information, it is difficult to predict whether a 170-to-340-foot no-harvest buffer along Class I streams would be sufficient to prevent all changes in all components of microclimate. The literature recommends that at least a 575-foot distance from the edge of a clearcut is needed to provide complete protection of microclimatic conditions comparable to interior old growth (Chen, 1991; Chen, 1992). The RMZs along Class II streams would be expected to provide less protection of riparian microclimate. Therefore, this alternative would be expected to provide moderate-to-high protection of riparian microclimate, but not complete protection.

Alternatives 2 (Proposed Action/Proposed Project) and 2a (No Elk River Property)

Under this alternative, microclimate in the RMZ buffers would be expected to receive more protection than that received from FPRs (prior to coho considerations) because of the no-harvest portion of the RMZ. However, none of the buffers under this alternative would approach the 570-foot buffer estimated to protect all components of riparian microclimate. Overall, Class I stream RMZs would be expected to provide moderate protection, while Class II stream RMZs would be expected to provide low protection for property-wide prescriptions.

Approximately 2,393 acres of riparian habitat would be placed in the Reserve under Alternative 2 and 1,568 acres under Alternative 2a (Figure 3.7-5 and Appendix Table J-2). These reserve acres would ultimately be maintained or restored to levels equivalent to an old-growth system over the extended long term (50-plus years) and would, therefore, provide complete protection of riparian microclimate function. The recovery time before the RMZ buffer would be restored to a level equivalent to preharvest conditions would depend on the age of the current stand (see Table 3.7-11). In Alternative 2b, approximately 447 riparian acres of Elk River Timber Company lands would not become part of the Reserve. Therefore, these Elk River Timber Company lands would be provided the same level of protection as that described under Alternative 1. There is some level of uncertainty as to whether the buffer widths described under Alternative 1 would be sufficient to protect the riparian microclimate function (see Alternative 1). Additional riparian acreage found in the MMCAs would not be harvested. As a result, the additional acres are included under Category A—no harvest, found in Figure 3.7-5 and Appendix Table J-3. They would ensure complete protection from any loss of riparian microclimate function.

Alternative 3 (Property-wide Selective Harvest)

The main protection measure of Alternative 3, before watershed analysis, would be the creation of large no-harvest buffers on all streams similar to Alternative 1. These buffers would not meet the buffer width requirements recommended in literature for providing complete protection of riparian microclimate function. After watershed analysis, the harvest in the RMZ could cause further reduction in the RMZ's capacity to maintain riparian microclimate functions.

Based on the EBAI values for LWD, in Salmon Creek and Middle Yager, complete protection would be provided to all streams in these HUs from the no-harvest status of old-growth and residual old-growth stands, and the no-harvest 600-foot buffers around these stands (see Section 2.4). Many of the HUs are expected to have more riparian areas that could provide complete microclimate function (due to the no-harvest stands) than is found in the same HUs in all other alternatives. Consequently, these no-cut areas would provide the width recommended in the literature to ensure that all components of riparian microclimate function would be protected.

Alternative 4 (63,000-acre No-harvest Public Reserve)

Alternative 4 RMZs for Class I and II streams in the PALCO HCP planning area would follow the same buffer requirements and harvest restrictions as Alternative 2.

As a result, RMZs would not be sufficient to maintain riparian function for microclimate function at or near conditions for all stream classes found in a mature stand.

The protection of RMZs provided from the 63,000-acre Reserve would ensure full protection to Elk River, Lower Yager, Middle Yager, and North Yager for all streams in the HU within the planning area. For these HUs, more protection would be provided for microclimate function under this alternative than in all others.

3.7.5 Mitigation

After reviewing and evaluating public comments on the Draft EIS/EIR in light of FESA and CESA permit issuance criteria, the wildlife agencies have determined that additional measures are appropriate to minimize and fully mitigate the impacts of take and to further reduce potential adverse effects. The complete package of minimization and mitigation measures is presented in the proposed HCP's Operating Conservation Program in Appendix P. Additional mitigation would include the following:

1. Increase the total buffer in the Humboldt WAA to 130 feet, as in the other WAAs.
2. Require RMZs along Class III streams. The RMZ for Class III streams is divided into two bands. The bands measure 0 to 50 feet for slopes less than 50 percent and 0 to 100 feet for slopes 50 percent and greater from the watercourse transition line.
   a. If any area within the Class III RMZ falls within the definition of a mass wasting area of concern, then the mass wasting strategy applies.
   b. All areas within the RMZ are EEZs for timber operations, except for roads and permitted equipment crossings.
   c. PALCO shall not harvest, including sanitation salvage and exemption harvest, in the 0- to 30-foot band, with the exception of 1,400 acres of commercial harvest (identified in Appendix P) and 775 acres of commercial thinning (identified in Appendix P).
3. Prescriptions for Class III buffers with slopes less than 50 percent include the following:
   a. A no-harvest band from 0 to 30 feet, including sanitation salvage or exemption harvest, with the exception of the 1,400-acre commercial harvest area and the 775-acre commercial thinning area identified previously.
   b. A sediment filtration band from 30 to 50 feet (details found in Appendix P).
4. Prescriptions for Class III buffers with slopes 50 percent and greater include the following:
   a. A no-harvest band from 0 to 30 feet, including sanitation salvage or exemption harvest, with the exception of the 1,400-acre commercial harvest area and the 775-acre commercial thinning area identified previously.
   b. A sediment filtration band from 30 to 100 feet (details found in Appendix P).
5. Prescriptions for Class III streams found in 1,400 acres of mid-successional and late seral vegetation types that are permitted for commercial harvest and 775 acres permitted for commercial thinning include the following:
   a. A no-harvest band from 0 to 10 feet.
   b. Maximum removal of 1/3 conifer volume and 1/3 conifer basal per 200 linear feet.

c. Thinning and harvesting will be distributed across all diameter classes.

6. Other mitigation items to briefly summarize for this section include the following:

   a. Clarifying largest tree retention if there is future entry into the 30- to 100-foot zone of Class I and II RMZs after watershed analysis. For Class I streams in particular, the 18 largest conifer trees per acre shall be retained. Also, for Class I and II streams, exclusive of the 18 largest trees per acre, any additional trees left for retention shall include those with the highest probability of recruitment to the stream.

This additional mitigation would provide the following protection:

- For Class III streams, it will reduce the delivery of any fine sediment from overland flow.
- It will maintain more LWD in Class III streams. This will reduce sediment transport and minimize the potential for gullying in these channels.
- It will protect streambank stability through the maintenance of tree root strength.
- It will maintain more production of leaf and needle litter for Class III streams. It will provide the associated delivery of detritus input to downstream Class I and II streams.
- Following watershed analysis, the additional mitigation will provide assurances that LWD recruitment potential for Class I and II streams will be maintained within the RMZ, with particular attention given to the largest and most recruitable trees.

3.7.6 Cumulative Effects —Wetlands and Riparian Lands

Cumulative wetlands and riparian effects under all alternatives were evaluated at the individual watershed level because most effects would be contained within this boundary or areas downstream. The two main factors that were considered in the evaluation included:

1. the percentage of PALCO ownership in an individual watershed (Table 3.6-7)
2. land uses (and ownership) authorized by county plans (Table 3.6-8).

The proposed prescriptions for RMZs would be implemented across the Project Area. The designation of the Headwaters Reserve would involve complete protection of all riparian and wetland functions. Stream buffers on PALCO-managed lands (under all alternatives to varying degrees) are expected to minimize direct and indirect effects compared to current management. Consequently, implementation of all alternative will reduce potential cumulative impacts in the watersheds with PALCO ownership: (1) minimizing sedimentation associated with channel-bank erosion to streams and wetlands; (2) enhancing sources of LWD and shade for streams and wetlands; and (3) restoring or retaining mature, compositionally and structurally diverse streamside forests capable of providing bank stability, habitat components, and some degree of wind and microclimate protection. These alternatives should reduce the watershed-wide cumulative effects by minimizing riparian and aquatic disturbances from PALCO-managed lands.

In general the percentage of PALCO ownership in an individual watershed was used to determine the potential cumulative effect of the Alternatives. The smaller the area owned by PALCO in a watershed, the smaller the potential for cumulative effects. For example, the Proposed Action/Proposed Project would likely have minimal cumulative effects on the Mad River watershed because PALCO owns only 1.2 percent of this watershed. In contrast, PALCO owns about 40 percent of the land in the Yager watershed (Table 3.6-7). Therefore, the Proposed Action/Proposed Project would affect a major portion of this watershed. The percentages of PALCO land ownership in each watershed are shown in Table 3.6-7. The percentages are also identified by HU. All non-PALCO ownership (e.g., other timber companies, public lands) was combined into one value per watershed.

Land use on non-PALCO lands is also important in evaluating the cumulative effects of the different alternatives within a watershed. For example, private timber lands would be managed under FPRs and new CDF coho considerations guidelines (CDF, 1997b) and federal National Forest System or BLM lands would be managed under the Aquatic Conservation Strategy of the Northwest Forest Plan. Other land uses such as agriculture, grazing, and rural community would also have effects on the watersheds. The land use designations of the watersheds of the Project Area are explained in section 3.6.5.3 and the proportion of land use by watershed are shown in Table 3.6-8 and Figure 3.6-8. The final landuse breakdown includes: timber production, agricultural, grazing, rural community, public land and open space.

Public lands vary widely in their use of the land. Some public lands in the area have a reserve status, such as Humboldt Redwoods State Park and Grizzly Creek Redwoods State Park lands which are managed for recreational purposes. Effects on riparian and wetlands systems resulting from park management are minimal. Park lands adjacent to PALCO HCP lands have no timber harvest that would disturb physical or biological functions and processes of the riparian system. National Forest System and BLM lands fall under the public lands category. Many of the National Forest System and BLM lands have been managed for timber extraction, resulting in similar types of riparian resource impacts as observed on PALCO managed lands. Recently, the Forest Service and BLM have increased protection of riparian and wetlands resources with the implementation of riparian reserves under the Northwest Forest Plan adopted in April 1994. Therefore, the effects of the plan in improving riparian and wetland habitat will occur over the next few decades and into the future.

Agricultural lands and range practices designated as grazing within the watersheds generally limit riparian and wetland functions. The conversion of riparian areas from forest to suburban development (i.e. rural community) limits preservation of riparian areas as well. The most common effects of housing development in a watershed that effect the riparian area are hardening of stream banks, such as levee construction or bank stabilization through riprap, and loss of riparian vegetation due to encroachment on the riparian zone by buildings and infrastructure. This designation indicates a potential for increasing development, although the rate of development is likely to be slow in this region (see Section 3.13). Agricultural or developed riparian lands throughout the basin may be maintained at a less functional state or continue to degrade over time as more building occurs. There are relatively few agricultural areas within the watersheds of the Project Area except in certain HUs in the Mattole watershed.

Wetlands on private lands will be affected primarily by FPRs and, to a lesser degree, by suburban development and agriculture. Wetland regulations at the federal, state, and county levels protect and mitigate wetland impacts associated with land development and management. Since wetlands are generally located in low areas of the landscape, however, they are susceptible to sediment influx from upland sources. Therefore, wetlands associated with developing or agricultural areas may degrade over time. Because wetlands within the Project Area are typically associated with riparian areas, the riparian cumulative effects discussion also applies to wetlands.

Private commercial timberlands outside of the Project Area, but within the same existing watersheds and HUs, have been intensively managed for timber production. Riparian protection has varied from no buffer, before FPRs, to limited protection under current rules. With the recent listing of coho salmon in California, current FPRs have been modified to include coho considerations. More restrictive measures have been developed to incorporate new coho habitat guidelines to maintain and improve habitat. As a result, these new guidelines are anticipated to strengthen riparian function on all watersheds that are known to have coho salmon populations within their boundaries. These new guidelines will be applied to all the watersheds that include PALCO lands. The approximate total land acreage of the THPs in Humboldt county that are either ongoing or recently completed include: 17,000 acres in the Bear-Mattole WAA, 107,000 acres in the Eel River WAA, 48,000 acres in the Humboldt WAA, 18,000 acres in the Van Duzen WAA, and 35,000 acres in the Yager WAA (these values include PALCO operations). Additionally, other HCPs are being developed that should have similar levels of beneficial effects as the HCPs being developed for PALCO lands.

Current degraded aquatic and riparian habitat throughout managed lands on the watershed and HU scale suggests that private, state, and federal entities have not provided adequate riparian protection in the past. All the alternatives in this EIS/EIR, the Northwest Forest Plan, and the coho considerations for riparian functions will contribute measurably toward a long-term reduction in cumulative impacts to riparian zones and associated wetlands. In the midterm (e.g., next several decades), however, stream systems throughout the landscape will continue to exhibit lingering problems associated with past management practices.

Despite the fact that all alternatives in this EIS/EIR will contribute more toward a long-term reduction in cumulative impacts to riparian zones and associated wetlands, each alternative provides differing levels of protection. Alternative 4 would have similar protection of riparian function through RMZ prescriptions as Alternative 2 except that 63,000 acres of PALCO lands and 18,801 acres of riparian lands would become a no-harvest Reserve in the Humboldt WAA (7,107 of riparian acres), VanDuzen WAA (355 of riparian acres), Yager WAA (10,312 of riparian acres), and Eel WAA (1,026 of riparian acres). Alternative 3 riparian prescriptions are more protective then both Alternatives 2 and 4 and the riparian and wetlands protected in association with marble murrelet conservation areas and their 600 ft buffers would provide additional protection to riparian and wetlands (similar to the protection found in the Reserves).

Given that PALCO lands under all alternatives would more successfully minimize direct and indirect effects on PALCO managed lands, these alternatives would contribute substantially toward reducing landscape-wide cumulative effects in the mid to long term. This contribution would occur particularly in watersheds where PALCO has greater ownership and thus a greater effect on the landscape. Greater protection of riparian functions and processes on PALCO-managed lands would enhance the positive effects of riparian conservation on adjacent public park lands. Additionally, it will offset, to some degree, the ongoing impacts on private lands by providing healthy habitat and refugia.

3.7.6.1 Watersheds

Mad River

The proportion of PALCO land within the entire Mad River watershed is less than 5 percent. Therefore, it is unlikely that any of the alternatives would have a noticeable cumulative effect despite the beneficial effects from implementation of the proposed HCP.

Freshwater Creek

PALCO owns approximately 56 percent of this watershed. The large proportion of this watershed owned by PALCO suggests that the designated riparian management under all four alternatives could have a substantial positive cumulative effect on riparian function and its contribution to a properly functioning aquatic system. The remainder of the watershed is designated as Rural Community. This designation indicates increasing urbanization in this watershed, although the rate of development is likely to be slow (see Section 3.13.). With urbanization, riparian habitat generally becomes degraded (Horner, et al., 1997). In addition, streambanks are typically reinforced or diked to protect property, which further reduces aquatic habitat. The large proportion of the land to be managed as Rural Community could offset the positive trend that would be developed under PALCO's management.

Elk River

Approximately two thirds of the Elk River watershed is owned by PALCO. Another 11 percent is designated for timber production by Humboldt County. The remainder of the watershed is in community planning area. Under the proposed HCP, the Headwaters Reserve would protect approximately 17 percent of the total stream miles in the watershed. The prescriptions in the proposed HCP combined with FPRs with coho considerations for the timber lands should result in improvements in riparian function. The remainder of the watershed is designated as Rural Community. The potential for future riparian habitat degradation in those areas is moderate depending on the rate of development and the types of land-use restrictions in riparian areas. In the long-term, similar to Freshwater Creek the long-term effects from Rural Community could offset improvements on PALCO lands in the upper watershed that would result from the implementation of the HCP.

Salmon Creek

PALCO ownership is limited to 4.8 percent of the Salmon Creek watershed. It is therefore unlikely that the proposed HCP would have a noticeable cumulative effect on riparian function and its contribution to a properly functioning aquatic system. Noticeably, in localized areas the proposed HCP would represent an improvement in riparian function.

Eel River

The area of the Eel River watershed is almost 2 million acres. Public lands account for approximately 34 percent of the area, which is the highest land use designation in this watershed. PALCO's ownership accounts for about 6 percent of the watershed, or 3.6 percent if the Van Duzen River and Yager Creek watersheds are not included (Table 3.6-7). Therefore, it is unlikely that the HCP would have substantial cumulative effects on the entire watershed. However, the proposed HCP would complement the land management strategies on public lands. Together PALCO's HCP and Public lands should improve riparian function and its contribution to a properly functioning aquatic system.

The Van Duzen River and its tributary Yager Creek are considered separately because the Ban Duzen River joins the Eel River only 12 miles from its mouth. The Van Duzen River, therefore, can only affect the lowermost parts of the Eel River.

Van Duzen River

PALCO owns approximately 14 percent of this watershed. The land use designations are 66 percent Timber Production and about 12 percent grazing. About 21 percent of the watershed is either currently developed or is planned for development.

The proposed HCP would contribute to the overall riparian function with in the Van Duzen watershed. The non-PALCO timberlands in this watershed would be managed under FPRs with coho considerations, or according to other HCPs now being developed. Therefore, the negative effects of timber harvest activities on riparian function should diminish relative to past conditions, and reduce management-related effects to riparian function in the long-term and therefore contribute to the improvement of a properly functioning aquatic system.

YAGER CREEK/LAWRENCE CREEK

The four HUs within the Yager Creek/Lawrence Creek watershed (Lawrence Creek, Lower Yager, North Yager, and Middle Yager) are considered together. PALCO owns approximately 40 percent of this total watershed (Table 3.6-6).

Land use is 58 percent timber production and 41 percent grazing (Table 3.6-7). Non-PALCO ownership under timber production occupies about 15 percent of the watershed (Figure 3.6-8). Non-PALCO timber production areas are expected to include salmon habitat protection measures from either FPRs with coho considerations or other HCPs at some time in the future. These measures should improve riparian and associated wetlands conditions and function. With approximately half of the watershed used for grazing, the maintenance or improvement of riparian function is expected to be somewhat less than those watersheds that are mostly designated for timber production.

Bear River

PALCO owns approximately 25 percent of this watershed, mostly in the upper reaches. Overall, land use in the watershed is about evenly divided between grazing and timber production. Ridge tops in the area are relatively open and grassy and most grazing occurs there. Any concentrated grazing in riparian areas would be expected to reduce riparian function and contribute to localized aquatic degradation. However, the PALCO lands should offset some of these localized effects. Non-PALCO timber producing lands (25 percent of the watershed) would be managed under FPRs with coho considerations unless HCPs are developed. Notably, the proposed HCP would contribute to the improvement of riparian function throughout the watershed, and therefore in the improvement of aquatic habitat compared to current conditions. Consequently, potential effects should be positive relative to existing conditions.

Mattole River

PALCO owns approximately nine percent of this watershed. A total of 36 percent of the watershed is designated for timber production. Grazing accounts for an additional 30 percent of land use. There is only a small proportion designated as Rural Community. Approximately 15 percent of the watershed is on public lands, most of which are federal. The public lands would be managed under the Aquatic Conservation Strategy of the Northwest Forest Plan. The measures contained within the Aquatic Conservation Strategy, along with those in the proposed HCP and FPRs with coho considerations, would combine to cause a gradual improvement in riparian function and associated wetland function which would assist in the improvement of the aquatic system.